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# PHYTOLOGIA

*An international journal to expedite plant systematic, phytogeographical and ecological publication*

Vol. 87

August 2005

No. 2

J. R. SPENCE, New genera and combinations in the Bryaceae (Bryales, Musci) for Australia.....	61
H. ROBINSON, Validation of the supertribe Asterodae.....	73
H. ROBINSON, <i>Parapolydora</i> (Asteraceae), a new genus of Vernonieae from South Africa.....	75
H. ROBINSON, New species and new combinations in the tribe Vernonieae (Asteraceae).....	80
R. D. ADAMS and S. NGUYEN, Infra-specific variation in <i>Juniperus deppeana</i> and f. <i>sperryi</i> in the Davis mountains of Texas: Variation in leaf essential oils and random amplified polymorphic DNAs (RAPDS).....	97
J. L. PANERO and A. G. PAUCAR, A new species of <i>Syncretocarpus</i> (Asteraceae: Heliantheae: Helianthinae) from central Peru.....	110
R. E. STOTLER, W. T. DOYLE and B. J. CRANDALL-STOTLER, <i>Pymatoceros</i> gen. nov. (Anthocerotophyta).....	114
W. C. HOLMES and J. R. SINGHURST, The status of <i>Blephilia</i> (Lamiaceae) in Texas.....	118
J. R. SINGHURST, E. L. KEITH, and W. C. HOLMES, Three species of vascular plants new to Texas.....	124
B. R. MACROBERTS and M. H. MACROBERTS, <i>Agrimonia gryposepala</i> (Rosaceae) deleted from the Louisiana flora.....	129
L. LOCKETT, From Espinosa's strawberry vines to Lindheimer's fan-shaped Agaves with forty-foot stems: The pitfalls of taking translations of early descriptions at face value.....	132
New Names and New combinations in volume 87(2).....	137

# PHYTOLOGIA

(ISSN 00319430)

*Phytologia*, a journal of plant systematics, phytogeography and vegetation ecology, is published three times a year.

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*Phytologia*  
P.O. Box 2012  
Sam Houston State University  
Huntsville, TX 77341-2012

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Publication date September 14, 2005.



184m "105  
NOV 21 2005*Phytologia* (Aug 2005) 87(2)

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**NEW GENERA AND COMBINATIONS IN THE BRYACEAE  
(BRYALES, MUSCI) FOR AUSTRALIA****John R. Spence**

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**ABSTRACT**

Two Australasian species of *Bryum* are transferred to *Ptychostomum* Hornsch. The genus *Gemmabryum* is newly described for the species of *Bryum* in sections *Alpiniformia*, *Apalodictyon* and *Doliolidium* and *Brachymenium* section *Dicranobryum*. The type species, *G. pachytheicum* (*Bryum pachytheica* Müll. Hal.) and 24 other Australian species are transferred to *Gemmabryum*. The genus *Ochiobryum* is newly described for *Bryum blandum* and *B. handelii*.

**KEY WORDS:** Australia, mosses, Bryaceae, *Gemmabryum*, *Ochiobryum*, *Ptychostomum*, *Bryum*

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**INTRODUCTION**

Research on the family Bryaceae for the *Flora of Australia* has resulted in the publication of the new genus *Rosulabryum* (Spence 1996, Spence & Ramsay 1999a) and the newly described genera *Ochiobryum* and *Gemmabryum*. In addition, the reinstatement of the genus *Ptychostomum* applies to many of the species previously recorded for *Bryum* s.str. as explained in the work on North American species by Spence (2005). In our Australian studies, since the proposal put forward to the Bryophyte Committee on Nomenclature (Spence &

Ramsay 1999b) was rejected, we have acknowledged *Bryum argenteum* as the type for the genus but limit the genus *Bryum* to those 5 species described by Spence & Ramsay (2002) as being referable to *Anomobryum*, the latter now being in synonymy with *Bryum*.

This paper was written in conjunction with that on the family in North America (Spence 2005). In both papers, we have taken a new look at *Bryum* and related genera, primarily using characters of the gametophyte. The phylogenetic basis of our revisions will be published elsewhere (Spence & Ramsay in prep.). Here, we describe two new genera, *Gemmabryum* and *Ochiobryum*. The former accommodates those species of *Bryum* and *Brachymenium* characterized by a combination of elongate distal and median lamina cells, short and wide proximal cells, imbricate leaves, general lack of a leaf border (limbodium), costa with guide cells, and the presence of several different types of asexual gemmae. Our work indicates that this is a well-defined group based on morphology, and it is most closely related to true *Bryum*, typified by *B. argenteum*. The second genus, *Ochiobryum*, is described for a pair of distinctive, closely related Asian-Australasian species of *Bryum* which have complanate leaves, unique in the Bryaceae.

The genus *Ptychostomum* was described by Hornschuch in 1822 for the species now known as *Bryum algovicum* and *B. uliginosum*. Our work, as well as other research based on DNA sequences and morphology (e.g., Pedersen et al. 2003; Cox & Hedderson 2003) indicates that these species form a well supported clade. *Ptychostomum* is primarily Northern Hemisphere in its distribution, with a few species in southern temperate and subantarctic regions. Because most species occur only in the Northern Hemisphere, with more than 40 in North America alone, most transfers were made elsewhere (Spence 2005). Two Australasian species are recombined below.

*Ptychostomum* Hornsch., Flora 5, 2: syll. 62, 1822.

Type species: *Ptychostomum cernuum* (Hedwig) Hornsch.  
Basionym *Cynodontium cernuum* Hedwig, Species Musc. 58. t. IX.  
1801. TYPE: In fissuris rupium malidis Sueciae, legit. Ol. Swartz (G).

*Ptychostomum altisetum* (Müll. Hal.) J.R. Spence & H.P. Ramsay  
**comb. nov.** Basionym: *Bryum altisetum* Müll. Hal., Hedwigia 37:  
96, 1898. Protologue: Australia, Victoria, Moyston, Oct. 1883: *D.*  
*Sullivan* 1883 misit; prope Dimboola, Oct. 1893: *F. Reader* mis.  
1894.

*Ptychostomum cylindrothecium* (R.Br.ter.) J.R. Spence & H.P.  
Ramsay **comb. nov.** Basionym: *Bryum cylindrothecium* R.Br.ter.,  
Trans. New Zeal. Inst. 31, 1899. Protologue: New Zealand, damp  
banks, Waikari, April 1882: *R. Brown*.

*Gemmabryum* J.R. Spence & H.P. Ramsay **gen. nov.**

Caules gemmiformes vel uniformiter foliati. Folia imbricata, ovata  
vel ovato-lanceolata, areolatione laminae heterogenea, cellulis  
distalibus atque medianis elongatis, proximalibus quadratis vel brevi-  
rectangulis latioribus. Costa in sectione transversali cellulis ducum in  
strato unico adaxialiter supra stratum stereidarum bene effectum sitis  
praedita, margine unistratosa non vel sublimbata. Gemmae asexuales  
vulgares, tubera sphaerica rhizoidalia, caules moniliformes  
rhizoidales aut bulbili axis foliaris. Plantae dioicae vel raro synoicae.  
Capsulae nutantes vel rectae; peristomium perfectum vel reductum,  
ciliis brevibus vel nullis, membrana basali humili, segmentis  
endostomii perforationibus carentibus; peristomia reducta cum capsulis  
rectis conjuncta. Sporae parvae, 8–20 (–25)  $\mu\text{m}$  diametro.

**Stems** gemmiform or evenly foliate, simple to branched by sub-  
gametangial innovations, sparsely to densely rhizomatous, with both  
micronemata and macronemata; creeping stolons absent. Rhizoids  
usually pale or red to red-brown, rarely purple, papillose. **Leaves**  
imbricate or slightly twisted when dry, ovate to ovate-lanceolate or  
triangular, concave to flat; costa strong, not reaching apex to excurrent  
in hairpoint, in cross-section with single layer of guide cells ventral to a



well-developed stereid band; lamina margins smooth or serrulate distally, unistratose, not or sometimes weakly bordered by 1 or 2 rows of incrassate linear cells, areolation heterogeneous, with elongate hexagonal, rhomboidal or vermicular distal and median cells and quadrate to short-rectangular and wider proximal cells across leaf base or sometimes differentiated from justacostal cells in alar region only, quadrate auriculate subalar decurrency of inflated cells absent. **Specialized asexual gemmae** common, including sphaerical rhizoidal tubers, moniliform rhizoidal tubers, stem tubers, leaf axis bulbils, and flagelliform branchlets. **Sexual condition** dioicous or rarely synoicous. **Seta** elongate, red to brown, not geniculate or curved. **Capsules** nodding to erect, short-ovate to pyriform, rarely elongate-clavate, often with a thick wrinkled apophysis; peristome double, perfect or reduced, exostome teeth 16, lanceolate, acuminate, fused at extreme base, yellow to brown, hyaline at tip, generally densely papillose on outer surface, usually bordered, trabeculate at back; endostome extremely variable, finely papillose, basal membrane well developed with segments keeled and perforate to poorly developed, cilia 0–4, nodulose or appendiculate, sometimes cilia short or absent, strongly reduced peristome associated with erect capsules; annulus large and revolvable; opercula hemispheric or convex conic, umbonate or apiculate, occasionally rostrate; stomata superficial, numerous in neck. **Calyptra** cucullate, smooth, naked. **Spores** small, 8–20 (–25)  $\mu\text{m}$  diam., smooth to finely papillose.  $n = 10, 11, 20, 21, 30$  in Australia (Ramsay & Spence 1996).

Type: *Gemmabryum pachythecum* (Müll. Hal.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum pachytheca* Müll. Hal., Syn. 1: 307, 1848. Protologue: Nova Hollandia prope York: *Preiss. India Orientalis: Hb Gottscheanum*.

Species of *Gemmabryum* are morphologically related to true *Bryum* (*B. argenteum*), with similar lamina areolation, but they can be distinguished by a variety of features. Stems tend to be bud-like or, if elongate, they are not julaceous; the costa is strong, often excurrent, with guide cells, and there are several different types of specialized asexual gemmae produced. The principal gemmae include rhizoidal

tubers, stem tubers and axillary bulbils. Four traditional sections of *Bryum* and *Brachymenium* belong to *Gemmabryum*: *Bryum* sections *Alpiniformia*, *Apalodictyon*, *Doliolidium* and *Brachymenium* section *Dicranobryum*. This is the largest genus of the Bryaceae in Australia with 25 species, and with perhaps 125 species worldwide. The following new combinations are made for species known from Australia.

***Gemmabryum acuminatum*** (Harv. ex Hook.) J.R. Spence & H.P.

Ramsay **comb. nov.** Basionym: *Brachymenium acuminatum* Harv. ex Hook. Icon. Pl. Rar. 1: 19, 1836.

***Gemmabryum apiculatum*** (Schwaegr.) J.R. Spence & H.P. Ramsay

**comb. nov.** Basionym: *Bryum apiculatum* Schwaegr. Spec. Musc. Suppl. 1(2): 102 t. 72, 1816. Protologue: In America meridionali lectum, ni fallor, *Richardus dedit*.

***Gemmabryum australe*** (Hampe) J.R. Spence & H.P. Ramsay **comb.**

**nov.** Basionym: *Bryum australe* Hampe, Icon. Musc. t. 26, 1844. Protologue: In Nova Hollandia, ad flumen Cygnorum: *Dr. L. Preiss legit*.

***Gemmabryum austrosabulosum*** J.R. Spence & H.P. Ramsay **nom.**

**nov.** Basionym: *Bryum sabulosum* Catcheside ex Spence & Ramsay, J. Adelaide Bot. Gard. 17: 114, fig. 4, 1996. Protologue: Western Australia, Porongorups, *F. Mueller s.n.*, x.1867 (MEL 30812), hom. illeg.. non Thériot, Recueil Publ. Soc. Havraise Études Dir. 1929: 111. 1930.

The name *B. sabulosum* already exists for a species from Madagascar (M. Crosby pers. comm.). We therefore provide a new name.

***Gemmabryum cheelii*** (Broth.) J.R. Spence & H.P. Ramsay **comb. nov.**

Basionym: *Bryum cheelii* Broth. Proc. Linn. Soc. New South Wales 41: 591, 1916. Protologue: Australia, N.S.W.: Shell Harbor: *Cheel n. 407*.

*Gemmabryum chrysoneuron* (Müll. Hal.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum chrysoneuron* Müll. Hal., Bot. Zeitung (Berlin) 9: 549. 1851. Protologue: Nova Seelandia, paludes sylvarum "Kauri forests" et "fern land" nuncopatarum ad fumen Wairoa-river prope portuna Kaipara, Ceratodoni purpureo intermixtum. *Cool.* No. 730.

*Gemmabryum clavatum* (Schimp.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Pohlia clavata* Schimp., Ann. Sci. Nat., Bot., ser.2 6: 148, 11, 1836. Protologue: ad scaturigines collium provinciae Quillota Chiles, ubi. clar. Bertero, anno 1829, legit cumque n. 867 in suo herbario adnotavit.

*Gemmabryum coarctatum* (Bosch & Sande Lac.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum coarctatum* Müll.Hal., *Syn. Musc.Frond.* 1: 312 (1849); *Brachymenium coarctatum* Müll.Hal.) Bosch & Sande Lac., *Bryol. Javan.* 1: 140, t. 115 (1860). T: Ost Java, bei Jogjakarta, [Indonesia], *Junghuhn*; holo: *n.v.*

*Gemmabryum coronatum* (Schwaegr.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum coronatum* Schwaegr. Spec. Musc. Suppl. 1(2):103, 1816. Protologue: In Guiana legit. cl.: *Richard*; In Jamaica: *Swartz*.

*Gemmabryum crassum* (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum crassum* Hook. f. & Wils. Fl. Nov. Zel. 2:86, 1854. Protologue: New Zealand, Northern Island: scoriae at Manukau Bay, west coast, Colenso.

*Gemmabryum dichotomum* (Hedw.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum dichotomum* Hedw., Spec. Musc., p. 183, 1801. Protologue: Nova Seelandia.

*Gemmabryum eremaeum* (Catcheside ex Spence & Ramsay) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum eremaeum*



Catcheside *ex* Spence & Ramsay, J. Adelaide Bot. Gard. 17: 112, fig. 3, 1996. Protologue: Australia, South Australia: Mirra Mitta Bore, midway between Marree and Birdsville: *R.E. Grandison s.n.*, ix.1978 (AD).

***Gemmabryum exile*** (Dozy & Molk.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum exile* Dozy & Molk., Ann. Sci. Nat. Bot. Sér. 3, 2: 300, 1844. Protologue: Java, Sumatra.

***Gemmabryum inaequale*** (Tayl.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum inaequale* Tayl., Lond. J. Bot. 5: 53, 1846. Protologue: Western Australia, Swan River: *Mr. James Drummond*.

***Gemmabryum indicum*** (Dozy & Molk.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum indicum* Dozy & Molk. Musci Fr. Ined. Archip. Indici. 1: 22, 1845. Protologue: Java: Trogon et in agro Boboriensi: *Korthals*; Amboina: in solo calcarea, intermixta Bryo coronato: *Zippelius*.

***Gemmabryum klinggraeffii*** (Schimp.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum klinggraeffii* Schimp. in Klinggr..., Höh. Crypt. Preuss., p. 81, 1858. Protologue: Am ufer eines tortigen Wiesengrabens in Wiszniewo bei Löbau. Juni.

***Gemmabryum laevigatum*** (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum laevigatum* Hook. f. & Wils. Lond. J. Bot. 3: 546, 1844. Protologue: Hermite Island, Cape Horn and Falkland Islands, barren.

***Gemmabryum preissianum*** (Hampe) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum preissianum* Hampe Icon. Musc. p.25, 1844. Protologue: In rupibus ad saxa calcarea Novae Hollandiae (prope Freemantle) celeberrimus peregrinator *Dr. Preiss legit*.

***Gemmabryum radiculosum*** (Brid.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum radiculosum* Brid., Spec. Musc. 3: 18, 1817. Protologue: Germ., Wurzelfaseriger Knotenmoor. Circa Romam in humidis herbidis legi., Maio.

***Gemmabryum rubens*** (Mitt.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum rubens* Mitt., Hooker's J. Bot. Kew Gard. Misc. 8: 232, 1856. Protologue: Throughout the temperate parts of Europe, Asia and northwest America. *B. erythrocrpum*,  $\beta$  *sylvaticum*, Hampe, Exsic. No. 201.—In sylvis Blankenburgieis.

***Gemmabryum sauteri*** (B.S.G.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum sauteri* B.S.G., Br. Eur. 4: 162, 377, 1846. Protologue: Ad terram humidum in jago bormiensi prope *Trafoi*, ad ripas arenosas fl. *Salzach* prope *Mittersill* et ad viam praeruptam inter Hof – et Bad-Gastein Salisburgiae inferioris W.P. Schimper annis 1840 et 1842 legit. Jullo.

***Gemmabryum subapiculatum*** (Hampe) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum subapiculatum* Hampe, Vid. Medd. Naturk. for Kjoebenh. Ser. 3, 4: 51, 1872. Protologue: *Glaziou*, sub Nr. 5148.

***Gemmabryum sullivanii*** (Müll. Hal.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum sullivanii* Müll. Hal. in Broth. Oefvers Forh. Finska Vetensk.-Soc. 35: 48, 1893. Protologue: Victoria, Mount William, ubi m. Nov. 1887 leg. *Sullivan* (n. 22).

***Gemmabryum tenuisetum*** (Limpr.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum tenuisetum* Limpr., Jahresber. Schles. Ges. Vaterl. Kult. 74 (2): 4, 1897. Protologue: Auf nasser Erde an einem Grabenrande vor dem Karrwalde bei Leibnitz in Steiermark bei 280 m am 8 März 1889 von *J. Breidler* mit nicht vollig ausgereiften Kapseinen entdeckt.

***Ochiobryum* J.R. Spence & H.P. Ramsay gen. nov.**

Caules uniformiter foliati. Folia complanata, ovata vel lanceolata, areolatione laminae e cellulis elongatis anguste hexagonis composita, marginibus distincte limbatis. Costa in sectione transversali cellulis ducum in strato unico adaxialiter supra stratum stereidarum bene effectum sitis praedita. Gemmae asexuales nullae. Plantae dioicae. Capsulae inclinatae vel nutantes pyriformes; peristomia duplicia bene effecta. Sporae parvae, 10–18  $\mu$ m.

**Plants** medium-sized, forming dense tufts 2–6 cm, variously coloured red, pink, silver or sometimes green, dark brown below. **Stems** simple or branched with short innovations, radiculose below. **Rhizoids** papillose. **Leaves** imbricate and appressed, concave, complanate, suberect to erect-patent, obtuse to broadly acute, little-altered when dry; costa weak, not reaching apex to shortly excurrent in a slender point, in cross-section with single row of guide cells ventral to a well-developed stereid band; laminal cells elongate, narrowly hexagonal to prosenchymatous, (6–15:1), often thicker-walled and narrower near margin, generally forming a distinct border, not much altered towards leaf base except at insertion,—where the cells are somewhat shorter and wider. **Asexual specialized gemmae** none. **Sexual condition** dioicous. **Seta** 2–4.5 cm long, slender, somewhat flexuose, reddish. **Capsules** 3–4 mm long, suberect or inclined, pyriform with a distinct tapered neck; opercula conical apiculate; peristome double, perfect, exostome teeth 16, lanceolate, acuminate, yellow to brown, hyaline at tip, endostome basal membrane well developed with segments keeled and perforate, cilia 2–4, appendiculate; annulus large and revoluble; opercula hemispheric or convex-conic, apiculate; stomata superficial, numerous in neck. **Calyptra** cucullate, smooth, naked. **Spores** 10–18  $\mu$ m.

Type: *Ochiobryum blandum* (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay **comb. nov.** Basionym: *Bryum blandum* Hook. f. & Wils., Lond. J. Bot. 3: 546, 1844. Protologue: Campbell's Island, barren.



One other Chinese species is also transferred to the genus:

*Ochiobryum handelii* (Broth.) J.R. Spence & H.P. Ramsay **comb. nov.**

Basionym: *Bryum handelii* Broth., Symb. Sin. 4: 58, 1929.

Protologue: Massenhaft in Bachläufen in der ktp. und Hg. St. des birm. Mons. in Hintergrunde des Doyon-lumba, vines linken Seitentales des Salwin, 28°9'. and Glimmerschiefer, 3600—4300 m, 5., 6. VIII. 1916 (9719).

This genus is described for the highly distinctive *B. blandum* and *B. handelii*, species with complanate leaves and elongate *Pohlia*-type lamina areolation. It is named in honor of the late Harumi Ochi (1920–2001), acknowledged expert on *Bryum*, who discussed the two species in one of his papers (Ochi 1968).

In Spence (2005) *Brachymenium* section *Leptostomopsis* was raised to generic rank. However, the sectional basionym was inadvertently left out, hence the combination is invalid. The corrected combination is cited below in full:

*Leptostomopsis* (Müll. Hal.) J.R. Spence & H.P. Ramsay **stat. nov.**

Basionym: *Brachymenium* sect. *Leptostomopsis* (Müll. Hal.)

Broth., in Engler & Prantl, Nat. Pfl. 1(3), 558. 1903. Type species:

*Leptostomopsis systylium* (Müll. Hal.) J.R. Spence & H.P.

Ramsay, **comb. nov.** Basionym: *Bryum systylium* Müll. Hal., Syn.

Musc. Frond. 1: 320, 1848. Lectotype: Mexico. Prope Xalapam,

Deppe & Schiede 1079 (L, NY).

## ACKNOWLEDGMENTS

This work was supported in part by grants from the Chanticleer Foundation to the Flora of North America Project to J.R. Spence and the Australian Biological Resources Study to J.R. Spence and H.P. Ramsay. The Missouri Botanical Garden and National Herbarium of New South Wales provided office space and equipment. Thanks are due to Richard Zander, Marshall Crosby and Bruce Allen of the Missouri Botanical Gardens and Barbara Briggs of the National

Herbarium of New South Wales for their support during the stay of J.R. Spence. We are grateful to Patricia Eckel for providing the Latin diagnoses. Thanks are due to Pat McCarthy and Marshall Crosby who kindly reviewed the manuscript. Kanchi Ghandi pointed out the error in *Leptostomopsis*, for which we are grateful.

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\_\_\_\_\_. and **H.P. Ramsay**. 2002. The genus *Anomobryum* Schimp. (Bryopsida, Bryaceae) in Australia. *Telopea* 9: 777-792.



## VALIDATION OF THE SUPERTRIBE ASTERODAE

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### ABSTRACT

The name for the Asteraceous supertribe Asterodae is validated.

**KEY WORDS:** Asteraceae, Asteroideae, Supertribe, supertribe Asterodae.

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In Robinson (2004) supertribes were introduced for the Asteraceae subfamily Asteroideae. At that time the supertribes Helianthodae and Senecionodae were validated and a supertribe Asterodae was left as a remnant. More recently Jim Reveal has called to my attention the lack of autonymy above the generic rank (Greuter et al. 2000) and this is confirmed by D. H. Nicolson of the U. S. National Herbarium. The result is that the remnant group Asterodae was not validated, lacking the necessary formal statement and latin. This brief note is intended to correct the oversight.

Asteraceae, subfamily Asteroideae, supertribe **Asterodae** H. Rob. **supertribus nov.** type *Aster* L. Achaenia in parietibus non phytomelaninifera plerumque raphidifera; bractae involucri non subvalvatae plerumque non herbaceae plerumque gradatae margine saepe late scariosae; thecae antherarum non vel longe caudatae; appendices antherarum abaxialiter non concavae; apices stylorum obtusae vel triangulares vel truncatae; receptacula raro paleata.

The included tribes are the Anthemideae Cass., Astereae Cass., Calenduleae Cass., and Gnaphalieae Cass. ex Lecoq. and Juillet.

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**PARAPOLYDORA (ASTERACEAE),  
A NEW GENUS OF VERNONIEAE FROM SOUTH AFRICA**

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**ABSTRACT**

The genus *Parapolydora* is newly described for the African species previously known as *Vernonia fastigiata*, differing from *Polydora* primarily by its perennial habit, achenes with numerous idioblasts, individual setulae uniseriate from near the base, and with pollen sublophate rather than lophate.

**KEY WORDS:** Asteraceae, Vernonieae, *Parapolydora*, new genus, Africa.

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The study of the paleotropical Vernonieae by Robinson (1999b) was the most complete review of the Vernonieae of the Paleotropical region since the more accurate delimitation of the genus *Vernonia* (Robinson 1999a). It was an effort to provide more appropriate generic names for many of the most common Vernonieae in the paleotropical region for the treatment in *The Families and Genera of Vascular Plants* edited by K. Kubitzki (in press). Time and herbarium resources were limited, and the result was, of necessity, incomplete. It was clear at the time that additional studies would be required for the many remaining unplaced species.

The present addition involves the placement of one species, *Vernonia fastigiata* Oliver & Hiern that has appeared in the last few years in collections and as a DNA voucher. The species clearly falls into the group treated as the subtribe Erlangeinae by Robinson (1999b). However, the species differs in important characteristics from every



genus presently recognized in the Erlangeinae. Of the nearly 30 known genera in the Erlangeinae, only 3 show a combination of stem pubescence, leaf insertion and form, corolla and pappus structure, and raphid shape that agree with those of *V. fastigiata*. All 3 of these genera are in the African subgroup of the Erlangeinae that has a glaucolide/hirsutanolide rather than a 5-methylcoumarin secondary metabolite chemistry (Herz 1996). These genera are *Hilliardiella* H. Rob., *Polydora* Fenzl., and *Vernoniastrum* H. Rob.

During the 1999 study, relationship of *Vernonia fastigiata* to *Hilliardiella* was initially suspected because of the non-lophate pollen. However, *Hilliardiella* differs by the canescent pubescence of symmetrically T-shaped hairs on the stems, leaf undersurfaces, peduncles, involucre bracts, and corollas. The presence of the T-shaped hairs on the corollas is particularly distinctive. In addition, *Hilliardiella* has only 12-20 florets in the heads, and the involucre bracts lack tomentum and lack abruptly constricted and reflexed awns.

Presently, *Vernonia fastigiata* is considered much more similar and presumably more closely related to two other members of the same group of Erlangeinae, *Polydora* and *Vernoniastrum*, both of which differ from *V. fastigiata* by having lophate, triplicate pollen. *Vernonia fastigiata* also differs from both the related genera in the setulae of the achenes which lose their biseriate condition near the base and have a single, long cell, rarely one long and one shorter cell, for most of their length. In *Polydora* and in the *Vernoniastrum* species that have setulae, the biseriate condition almost always continues for most of the setula length. In other respects *V. fastigiata* shows a mixture of *Polydora* and *Vernoniastrum* characteristics, and one species of *Polydora*, *P. angustifolia* (Steetz in Peters) H. Rob., has a smaller but very similar-looking involucre with tomentum and long awns. *Vernonia fastigiata* is consistently cited as a perennial, while species of *Polydora* are mostly annuals. The hairs in *V. fastigiata* include some that are L-shaped (one-armed T-shaped) as in *Polydora*, but the hairs in the latter are larger and not hidden among simple multiseptate hairs and coarser stout-based hairs. The corolla lobes of *V. fastigiata* are without hairs, and the anther bases are not tailed, both being characteristics of

	<i>Parapolydora</i>	<i>Hilliardiella</i>	<i>Polydora</i>	<i>Vernoniastrum</i>
<b>pollen</b>	sublophate-Type A	sublophate-Type A	lophate-triporate	lophate-triporate
<b>corolla</b>	no hairs	T-shaped hairs	few biseriate or none	lobes pilose distally
<b>stem</b>	L-shaped and simple	T-shaped hairs	L-shaped	pilose
<b>achenes</b>	many idoblasts	many idioblasts	few idioblasts	many idioblasts
<b>setulae</b>	mostly uniseriate	biseriate	biseriate	biseriate
<b>perennial</b>	yes	yes	mostly annual	yes
<b>raphids</b>	elongate	elongate	elongate	elongate
<b>heads</b>	45-50 florets	12-20 florets	ca. 30 florets	ca. 50 florets
<b>thecae</b>	no tails	tails short of none	no tails	short tails

**Table 1.** Character comparison of *Parapolydora* and the related genera *Hilliardiella*, *Polydora*, and *Vernoniastrum*.

*Polydora* and unlike *Vernoniastrum*. The achene walls have few or no glands, and have numerous idioblasts throughout, more like *Vernoniastrum* but unlike *Polydora*. The ca. 50 florets in the heads of *V. fastigiata* are matched in some *Vernoniastrum*, but *Polydora* is known to have as many as 30. The chromosome numbers of the perennial genera *Hilliardiella* and *Vernoniastrum* are  $n = 10$ , and the annual *Polydora* is  $n = 9$  (Jones 1979, 1982). The chromosome number of *V. fastigiata* is as yet unknown, but should be  $n = 9$  or 10 or a polyploid of 9 or 10.

The characteristics of the four genera are compared in Table 1.

In view of the number of similarities between *Vernonia fastigiata* and *Polydora*, the new genus is here named *Parapolydora*.

***Parapolydora*** H. Rob., **gen. nov.** Type: *Vernonia fastigiata* Oliver & Hiern.

Plantae herbaceae perennes; pilis variabilis interdum scabridis et base crassis vel uniseriate multiseptatis vel asymmetrice L-formibus. Rami inflorescentiae in capitulis longe pedunculatis terminati, bracteis involucri base tomentosis distaliter abrupte reflexe glabrate aristatis; flores ca. 50 in capitulo; thecae antherarum non caudatae; basi stylorum nodati; rami stylorum in pilis acicularibus obsiti; achaenia 8-10-nervata, idioblastis numerosis, setulis elongatis fere ad basim sensim uniseriatis, raphidis elongatis; pappus biseriatus, setis interioribus capillaribus distaliter non latioribus. Grana pollinis sublophata tricolporata echinata.

Perennial herbs 0.2-1.0 m tall; from slender prostrate or creeping stem or rhizome, erect stems with few to many ascending branches, 5-angled, scabrid with broad-based hairs on angles, sides with numerous glandular dots, finely and sparsely puberulous with some simple multiseptate hairs, and some one-armed L-shaped hairs with stalk near one end as in *Polydora*. Leaves alternate, linear to narrowly elliptic-lanceolate, venation pinnate with short, ascending, secondary veins weakly prominulous below, surfaces concolorous, glandular dots more numerous below, sparsely puberulous. Inflorescences of long-pedunculate heads terminal on leafy stems and branches; involucre broadly campanulate to subglobose; involucre bracts 110-130 in ca. 6 series, persistent, gradate, from 2 to 12 mm long, bases of bracts oblong, pale, appressed, covered with dense pale tomentum, bracts distally constricted into long glabrous, often reflexed awn, darkened along costa near base of awn; receptacle epaleaceous, alveolate. Florets 45-50 in a head; corollas lavender, without hairs, basal tubes narrowly funnelform, glabrous, throats about as long as linear lobes, few glands on throat and glands clustered at lobe tips; thecae of anthers without tails at base; apical appendages ovate-lanceolate, glabrous, with thin-walled cells; style base with distinct annular node; style



branches with long acicular sweeping hairs. Achenes weakly 8-10-veined, with setulae becoming long and uniseriate from near base, rarely with 1 long cell and 1 short cell, idioblasts numerous from base to top of achene, raphids elongate; pappus white or sordid white, inner series of many barbellate bristles, not broadened at tips, outer series of numerous, short, linear scales. Pollen ca. 50  $\mu$ m in diam., sublophate (Type A), tricolporate, echinate.

The genus has only the following single species.

*Parapolydora fastigiata* (Oliver & Hiern) H. Rob., **comb. nov.**, basionym: *Vernonia fastigiata* Oliver & Hiern in Oliver, Fl. Trop. Africa 3: 282 (1877). Specimens seen from Namibia, South Africa (Transvaal), and Zimbabwe.

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NEW SPECIES AND NEW COMBINATIONS IN THE TRIBE  
VERNONIEAE (ASTERACEAE)

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ABSTRACT

*Chresta hatschbachii*, *Critoniopsis diazii*, *C. macrofoliata*, *Lepidaploa irwinii* and *Vernonanthura cabralensis* are described as new and the combinations *Gymnanthemum triflorum*, *Hilliardiella sutherlandii*, *Leiboldia guerrereana*, and *Linzia accommodata* are made.

**KEY WORDS:** Vernonieae, *Chresta*, *Critoniopsis*, *Gymnanthemum*, *Hilliardiella*, *Leiboldia*, *Lepidaploa*, *Linzia*, *Vernonanthura*, Asteraceae.

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Examination of Vernonieae specimens since publication of the general treatment of the American members (Robinson, 1999a) and the limited treatment of Paleotropical members (Robinson, 1999b) has revealed various species that need to be described and combinations that need to be validated. These include species from Mexico, Peru, Brazil, and Africa. The present validations will allow proper identifications and annotations of specimens. This will also help to avoid the continued misuse of the generic name *Vernonia* for non-*Vernonia* species where a proper alternative is readily available.

Measurements of floral parts and pollen were taken from material in Hoyer's solution.

***Gymnanthemum triflorum*** (Bremek.) H.Rob., **comb. nov.**, basionym  
*Vernonia triflora* Bremek., Ann. Transvaal Mus. 15: 262 (1933).  
S. Africa.



Fig. 1. *Chresta hatschbachii* H. Robinson, Isotype, United States National Herbarium.

There is reason to believe that the concept of *Gymnanthemum* in Robinsom (1999b) was much too broad, but the present species is evidently in the typical element of the genus.

*Hilliardiella sutherlandii* (Harv.) H.Rob., **comb. nov.**, basionym  
*Vernonia sutherlandi* Harv. in Harv. & Sond., Fl. cap. 3: 52  
(1865). S. Africa.

The species has the T-shaped hairs on the stems, leaves, involucre and corollas that are characteristic of the genus (Robinson 1999b). The abaxial pubescence of the leaf is less dense than that in most species of the genus.

Further study of *Vernonia leopoldii* Vatke, which was transferred to *Hilliardiella* by Robinson (1999b), indicates that it does not belong to the genus. Its proper placement is still unresolved.

*Leiboldia guerreroana* (S.B.Jones) H.Rob., **comb. nov.**, basionym  
*Vernonia guerreroana* S.B. Jones, Castanea 44: 233 (1979).  
Mexico.

The species has the glabrous, rather turbinate, 5-ribbed achenes of the *Lepidonia* group of the Vernonieae (Robinson and Funk 1987). It has the slightly enlarged base of the style and elongate raphids characteristic of *Leiboldia* in that group. The ring inside the pappus is poorly defined, but it is most evident in the way the pappus bristles are clearly inserted below the rim of the apical callus of the achene.

*Linzia accommodata* (Wild) H. Rob., **comb. nov.**, basionym *Vernonia accommodata* Wild, Kirkia 5: 82 (1965). Zimbabwe.

The species has narrower leaves than most *Linzia* species. Nevertheless, the corollas are the blue color characteristic of the *Centrapalus/Linzia* alliance, and the pollen is lophate with spurs into the colpi, a type characteristic of *Linzia*. The involucre bracts have the characteristic numerous stiff marginal cilia of the genus, but not the obvious teeth seen distally in some species. The species seems to lack



the characteristic lines of idioblasts along the costae of the achene, but there are rows of thin-walled cells in those positions distinguished by their reddish pigment before the specimens were cleared in Hoyer's solution.

***Chresta hatschbachii* H. Rob., sp. nov.** TYPE: BRAZIL. Bahia:

Mun. Oliveira dos Brejinhos, Estr. Cana Brava a Chapadão de Cima, prox. Ao Alto da Serra Geral, Campo rupestre, afloramentos rochosos e no solo arenoso junto as roches, erva perene 50 cm, flor lilás, 16 Mar. 1998, G. Hatschbach, M. Hatschbach e E. Barbosa 67804 (holotype MBM, isotype US). (Fig. 1).

*A Chrestam harleyi similis sed in pedunculis brevibus valde differt.*

Perennial herbs 0.5-1.0 m tall, from stout creeping rootstock; stems essentially terete, weakly costate, densely white-tomentose with T-shaped hairs. Leaves alternate, lower leaves with petioles 0.5-1.0 cm long, upper leaves sessile, blades 2.0-3.5 cm long, 0.4-0.9 cm wide, lanceolate, pinnatifid with 6 or 7 blunt, rather oblong lobes on each side, sinuses reaching halfway to midrib, upper surfaces canescent with coarse T-shaped hairs, lower surface white-sericeous with T-shaped hairs. Peduncles mostly 1.0-2.5 cm long above distal reduced leaves. Heads sessile, 8-12 in clusters ca. 15 mm high, with crowded, minute, puberulous bracteoles at base of cluster of heads, individual involucre narrowly cylindrical, ca. 12 mm high, 2 mm wide, with ca. 20 ovate to narrowly linear bracts in 5-6 series, stramineous with dark median line and narrowly scarious margins, 2-9 mm long, acute with a short mucro. Florets 5 in a head; corollas lavender, ca. 14 mm long, with cylindrical capitate glands outside, mostly near throat, basal tube ca. 12 mm long, filiform below, narrowly funnelform above, sparsely pilosulous below, throat 0.1-0.2 mm long, lobes 5, linear, 2.5 mm long, ca. 0.5 mm wide; anther thecae ca. 1.3 mm long, spurs and collars ca. 0.4 mm long, no tail; apical appendages oblong-elliptic, ca. 0.35 mm long, 0.19 mm wide, with median crease, cells thin-walled. Achenes 1.2-1.5 mm long, sericeous with long, dense setulae, raphids elongate; pappus white, outer series of linear scales 0.7-1.0 mm long, inner flattened bristles 4-

6 mm long. Pollen sublophate (Type A), tricolporate, echinate, ca. 50  $\mu$ m in diam

PARATYPE: BRAZIL. Bahia: Mun. Oliveira dos Brejinhos, Estrada Oliveira dos Brejinhos/Agua Quente, ca. 6 km a partir de Oliveira dos Brejinhos, afloramentos no interior da floresta, Mata decidua, erva ca. 1.0 m alt., folhas cinéreas em ambas as faces, capitulos roxos, vistosos, frequente entre as pedras, 15 Apr 1999, *A.M. Amorin, R.C. Forzza, C.B. Costa & S.C. Sant'Ana 2867* (CEPEC, US).

The paratype label is entitled "Herbário Centro de Pesquisas do Cacau-CEPEC, Projeto Mata Atlantica Nordeste, Convênio CEPLAC/Jardim Botânico de Nova Iorque", and footnoted "Projeto Financiado pela Fundação John D. & Catherine T. MacArthur"

*Chresta hatschbachii* has narrow leaves with lobed margins reminiscent of *C. harleyi* H. Rob. but the leaves are generally much shorter and the sinuses of the blades reach nearer the midvein resulting in a narrower blade. The peduncles of *C. harleyi* are particularly distinctive, mostly about 30 cm long above the uppermost leaves, compared to the much shorter ones of the new species. .

***Critoniopsis diazii* H. Rob., sp. nov.** TYPE: COLOMBIA. Boyaca:

Boavita, Vereda Mamonal, El Boquerón, 2200 m; arbol de 3.5 m, hojas discoloras con envés ceniciento, flósculos blancos, anteras lila, abundante; 21 abril 1991; *S. Díaz P. 4381* (holotype COL, isotype US)(Fig. 2).

*A speciebus congeneribus in foliis apice obtusis vel rotundatis in pilis abaxialiter foliorum elongatis ultra basem simplicibus in inflorescentiis subthyrsiformibus in bracteis involucri interioribus brevibus apice obtusis et in floribus 8-10 in capitulo distincta.*

Trees to 3.5 m tall; distal stems to 4 mm wide, weakly 5-angled, striate, puberulous with small, irregularly lobed or pointed, glomerulate-stellate hairs; internodes short, mostly 0.3-0.6 cm long. Leaves alternate; petioles 0.8-1.5 cm long, blades rather stiffly herbaceous, oblong-elliptic, ca. 11 cm long, 4-5 cm wide, base



**Fig. 2.** *Critoniopsis diazii* H. Robinson, Isotype, United States National Herbarium.

gradually acuminate to petiole, margins entire, narrowly revolute, apex rounded to shortly obtuse, with 6 to 8 ascending secondary veins spreading at ca. 35°, upper surface glabrous, pilosulous on proximal parts of midvein and secondary veins, veinlets scarcely prominulous, lower surface softly, somewhat sparsely tomentose with slender, pale, mostly unbranched but basally lobed or spurred hairs. Inflorescence rather oblong-thyrsoïd, 9-10 cm high, 5.5-8.5 cm wide, with ascending to spreading branches diverging at 30-60° angles, tomentellous with pale slender hairs; heads ca. 8 mm high, in small corymbiform clusters with peduncles 0-2 mm long; involucre broadly campanulate, ca. 5 mm high and 4 mm wide; bracts at base minute, congested, greyish puberulous, larger bracts 35-40 in 4 to 5 gradate series, with appressed tips, 1.0-3.5 mm long, 1-2 mm wide, tips mostly obtuse, with exposed parts appearing short and rather semicircular, outside pale-brownish with dark median glanduliferous spot near tip, surfaces with few or no hairs especially on upper bracts, innermost bracts somewhat deciduous, with narrowed bases and moderately reflexed basal margins. Florets 8-10 in a head; corollas white, 6.5-7.0 mm long, mostly glabrous, with few glands distally, basal tube broad, ca. 3 mm long, throat ca. 1 mm long, lobes ca. 2.5 mm long, 0.5 mm wide; anther thecae lilac, ca. 2.5 mm long, spurs ca. 0.7 mm long, blunt with sterile margin at base; apical appendages ca. 0.4 mm long, 0.18 mm wide, with firm-walled marginal cells; style base with annular disk; style branches with blunt sweeping hairs. Achenes ca. 2.5 mm long, generally 3- or 4-angled with some weak ribs between the angles, without hairs, with some glands clustered near base, with numerous idioblasts on surface, with short-oblong raphids in walls; pappus with an outer series of brownish, narrow scales ca. 0.35 mm long, inner pappus of ca. 45 slender, white, deciduous bristles ca. 5.5 mm long, with broadened tips. Pollen grains ca. 47  $\mu$ m in diam, sublophate (Type A), tricolporate, echinate.

*Critoniopsis diazii* is known only from the type series. It seems closest to *C. pallida* (Cuatrec.) H. Rob. of Cauca, Colombia in habit, general aspect of the leaves with a narrowly recurved margin, the campanulate form of the involucre, and the 8-16 flowers in the heads. The inflorescence of the latter is more broadly corymbiform, the secondary veins of the leaves more prominent and more spreading, and





**Fig. 3.** *Critoniopsis macrofoliata* H. Robinson, Holotype, United States National Herbarium.

the hairs on the undersurface of the leaves are granular, not at all elongate. In contrast, the new species can be immediately distinguished by its slender hairs with two short, thin-walled basal

cells, and a single, long, firm-walled, flagelliform, somewhat contorted apical cell with basal bulges or spurs. The leaves of *C. pallida* are more abruptly acute at the base, and the apex is acute in the one least broken leaf. The involucral bracts are more pubescent with appressed hairs, the heads have 15-16 flowers, and the outer pappus series is mostly 1.5 mm long, white, and more irregular. Both species are known only from the types, and some of the lesser characters may prove variable when more specimens are found.

***Critoniopsis macrofoliata* H. Rob., sp. nov.** TYPE: PERU. Cajamarca: San Ignacio Prov., Tabaconas, La Bermeja, bosque primerio; 05°21'07"S, 79°17'01"W, 1600-1799 m; arbol 10 m, involucro marrón, vilano blanco; 19 Nov. 1997; *J. Campos & O. Cano* 4696 (holotype US, isotype MO). (Fig. 3, 6A).

*A speciebus ceteris generis in foliis alternis in laminis plerumque 25-30 cm longis abaxialiter dense tomentosis et in pilis tomenti ramosis et base armatis differt.*

Trees 8-10 m tall, distal stems 7-12 mm in diam., terete to subpentagonal, densely brownish-velutinous. Leaves alternate, petioles stout, 2-4 cm long, terete; blades oblong-elliptic, 25-30 cm long, 11-14 cm wide, base short-acute, margins entire, apex narrowly short-acuminate; secondary veins 11-12 on each side, ascending at ca. 45° angles; upper surface glabrous except puberulous midvein, veinlets scarcely insculcate; lower surface with veins and veinlets strongly exsculptate, covered with dense pale-brownish tomentum of branched hairs, bases of hairs with numerous retrorse spurs. Inflorescence corymbiform with numerous erect-spreading, elongate, somewhat scorpioid, densely seriate-cymose branches; surfaces velutinous to tomentellous, bracteoles small, linear, 2.5-3.0 mm long, densely tomentellous, scattered on seriate-cymose branches. Heads mostly 3-7 mm apart on branch, ca. 12 mm high, to 10 mm wide in fruit; outer mostly persistent involucral bracts ca. 50, erect-spreading, ovate, 1-3 mm long, tips straight, acute, outside unicostate, densely pilosulous with pale hairs; deciduous inner involucral bracts 12-17, narrowly elliptic, 5.0-6.5 mm long, ca. 1 mm wide at middle, base narrowed,

non-auriculate, basal margins not reflexed, distal half lanceolate, strongly recurved, pilosulous to tomentellous, apex narrowly acute, scarcely costate. Florets ca. 25; only old corollas seen in the plant debris, purple?, ca. 6 mm long, glabrous below, with scattered glands distally on lobes, basal tube ca. 3 mm long, throat ca. 1 mm long, lobes linear, ca. 2 mm long, 0.45 mm wide, coiling backwards with age; anther thecae ca. 2.4 mm long, spurs ca. 0.9 mm long, without tails, apical appendages narrowly triangular, ca. 0.55 mm long, 0.2 mm wide, glabrous, cells with slightly thickened porose walls, Achenes brown to blackish, ca. 4 mm long, 2- or 3-angled, nearly smooth on side toward involucre, 3- or 4-costate on side toward center of head, nearly glabrous, with idioblasts scattered or in short series, raphids short-rhomboidal; pappus white, outer series of linear scales ca. 0.5 mm long, inner series of 35-40 deciduous, slender bristles ca. 4.5 mm long, broadened distally. Pollen ca. 40  $\mu$ m in diam., sublophate (Type A), tricolporate, echinate.

PARATYPE: PERU. Cajamarca: San Ignacio Prov, Chirinos, localidad de Pacasmayo, bosque primerio, 05°15'00"S, 78°55'00"W, 1700-1800 m; arbol 8 m, involucro pardusco, aquenio negro, vilano blanco, 23 Oct 1997; *J. Campos & Z. Garcia 4524* (MO, US).

*Critoniopsis macrofoliata* has a superficial resemblance to *Vernonanthura diffusa* (Less.) H. Rob. of Brazil, and was provisionally determined as that some years ago in spite of considerable evidence, especially geographical, that it was not. Ultimately, it is not even in the same genus. Easily observed differences include the lack of setulae on the achenes and the complex branching of the abaxial hairs of the leaves. Another feature indicative of *Critoniopsis* is the easily deciduous inner bracts of the involucre with strongly recurved tips.

***Lepidaploa irwinii* H. Rob., sp. nov.** TYPE: BRAZIL. Minas Gerais: Serra do Espinhaço; ca. 29 km SW of Diamantina on road to Gouveia, rocky slopes; elev. 1300 m; herb ca. 50 cm tall, heads lilac-magenta, common; 14 Jan 1969; *H.S. Irwin, R. Reis dos Santos, R. Souza & S.F. da Fonseca 21902* (holotype UB, isotypes NY, US)(Fig. 4).

*A Lepidaploam rufogriseam similis sed in floribus 20-25 in capitulo et in corollis non piliferis distincta.*

Perennial herbs 0.5-1.5 m tall; stems and leaves covered with dense, short, bottle-shaped hairs attached near broader, rounded, lower end, forming dense, often brownish felt on upper stem and branches; stems weakly 10-costate. Leaves alternate; lower leaves with petioles ca. 1 mm long, with blades oblong-elliptic, to 3.5 cm long, 1.2 cm wide, base cuneate, margins 7- or 8-serrate, apex acute, upper surface greyish-green, puberulous with minute hairs and many glandular dots, lower surface densely whitish subsericeous; upper leaves subsessile, linear to narrowly elliptic, 1-2 cm long, 0.2-0.5 cm wide, often infolded and complicate, margins subserrulate to entire, surfaces as in lower leaves. Inflorescence with many arching, seriate-cymose branches, with bracteoles mostly linear as in upper leaves; mature heads mostly 1-2 cm apart, 8-10 mm high and wide; involucre bracts 37-40 in ca. 6 series, all appressed, short-ovate to oblong-lanceolate, 0.5-5.5 mm long, acute to short-acuminate, margins narrowly scarious, outer surface brownish or pale reddish and densely pilosulous, with many glandular dots distally. Florets 25-30 in a head; corollas lilac to magenta, 6-8 mm long, without hairs, with glandular dots especially distally on lobes, basal tube 2-3 mm long, throat ca. 1 mm long, lobes 3-4 mm long, 0.5-0.6 mm wide; anther thecae ca. 2.4 mm long, basal spurs 0.7 mm long, no tails; apical appendage narrowly triangular, 0.6-0.7 mm long, ca. 0.23 mm wide. glabrous, with thin-walled cells. Achenes ca. 2 mm long, densely sericeous with long setulae, with scattered idioblasts, raphids not seen in either specimen; pappus white, outer series of oblong-lanceolate scales 2.0-2.3 mm long, inner series of ca. 45 bristles 4.5-6.0 mm long, tapering from broadened bases to tips. Pollen ca. 55  $\mu\text{m}$  in diam., echinolophate, tricolporate with crosswalls in colpi above and below pores (Type D).

PARATYPE: BRAZIL. Minas Gerais: Mun. Serro, Cabeceiras do rio Jequitinhonha, Cascata Moinho de Esteira, campo rupestre; arbusto ramoso, 1.5 m, capitulo lilás; 25 Oct 1999; G. Hatschbach, R. Spichiger, A.C. Cervi & E. Barbosa 69727 (MBM, US).





**Fig. 4.** *Lepidaploa irwinii* H. Robinson, Isotype, United States National Herbarium.

The type of *Lepidaploa irwinii* was determined by Barroso as *Vernonia eremophila* Mart. ex DC., a synonym of *Lepidaploa rufogrisea* (St. Hil.) H. Rob. The latter species seems to be the closest relative, having similar arching branches in the inflorescence and the same type of bottle-shaped hair on the stems and leaves. The pollen with the crosswalls in the colpi is also characteristic of this group of *Lepidaploa*. The new species is most easily distinguished by the shorter, broader, less cylindrical involucres with more closely imbricated bracts, and by the ca. 20 rather than ca. 10 florets in the heads. The paratype, which lacks lower leaves, has a superficial resemblance to *L. tombadorensis* (H. Rob.) H. Rob. which is immediately distinct in its involucre bracts with denser pubescence and rounded to subtruncate tips.

***Vernonanthura cabralensis* H. Rob., sp. nov. TYPE: BRAZIL.**

Minas Gerais: Mun. Joaquim Felício, Serra do Cabral; campo rupestre, solo arenoso; alt. 950-1000 m; ereta, 1 m, flor lilás; 15 May 2001; G. Hatschbach, M. Hatschbach & E. Barbosa 72044 (holotype MBM, isotype US)(Fig. 5, 6B, C, D).

*A Vernonanthuram lucidam in foliis abaxialiter non tomentosis et non sericeis similis sed in capitulis majoribus, in floribus ca. 15 in capitulo et in pilis abaxialibus foliorum plerumque T-formibus distincta.*

Perennial herbs 0.4-1.0 m tall, apparently with woody rootstock; stems with many weak costae, hirsute near base, puberulous above, glabrescent. Leaves alternate, essentially sessile but sometimes slender at base, bases cuneate to acuminate, margins serrate, apices acute, upper surface scabrid, lower surface with numerous glandular dots and slender T-shaped hairs, lower leaves obovate to oblanceolate, 3.5-6.0 cm long, mostly 1.5-2.0 cm wide, median leaves narrowly elliptic to linear-lanceolate, 5-15 cm long, 0.5-2.5 cm wide, upper leaves and lower bracts of inflorescence linear, 1.2-3.0 cm long, 0.2-0.4 cm wide. Inflorescence corymbiform to broadly thyriform with strongly ascending cymose branches; peduncles 4-14 mm long; heads 10-14 mm high, with involucre 6-9 mm wide, mostly obconic to funnelform,



**Fig. 5.** *Vernonanthura cabralensis* H. Robinson, Isotype, United States National Herbarium.

usually with small bracts continuing onto upper half of peduncle; involucre bracts more than 50, in 6 or more series, mostly yellowish brown with darker tips, hairless and mostly glabrous outside, with clusters of glands distally, lower bracts scale-like, ca. 1.5 mm long, sharply acute, inner bracts to 6 mm long, narrowly oblong-elliptic, short-acute. Florets ca. 15 in a head; corollas 7-9 mm long, hairless, basal tube 4-5 mm long, throat 1.5 mm long, lobes 2.5-3.0 mm long, 0.5-0.8 mm wide, with ca. 6 longitudinal lines or ducts, with few glandular dots distally; anther thecae ca. 3 mm long, spurs ca. 0.9 mm long, with short tails; apical appendages oblong-elliptic, 0.7 mm long, 0.28 mm wide, appendages and connectives with scattered glands. Achenes ca. 2.6 mm long, 8-10-costate, with numerous short spreading setulae and glandular dots, raphids subquadrate; pappus white, outer series of many narrow scales 0.3-0.5 mm long, inner bristles 50-55, 3.5-4.0 mm long, not or scarcely broadened distally. Pollen ca. 50  $\mu$ m in diam., sublophate (Type A), tricolporate, echinate.

PARATYPES: BRASIL. Minas Gerais, Mun. Joaquim Felício, Serra do Cabral, Córrego Veado Esfolado; campo rupestre, solo arenoso, ereta, 40 cm, capítulo lilás; 14 Mar 1997; *G. Hatschbach*, *M. Hatschbach* & *E. Barbosa* 66230 (MBM, US); Mun. Joaquim Felício, Serra do Cabral, estrada para Francisco Dumont; 950 m; campo cerrado; ereta, 70 cm, capítulo lilás, 16 May 2001, *G. Hatschbach*, *M. Hatschbach* & *E. Barbosa* 72087 (MBM, US); Mun. Francisco Dumont, Serra do Cabral, estrada para Francisco Dumont, próximo do Rio Imbalaçaia; 950 m; campo cerrado, capítulo lilás; 16 May 2001; *G. Hatschbach*, *M. Hatschbach* & *E. Barbosa* 72101 (MBM, US).

*Vernonanthura cabralensis* would key generally in Stutts (1988) to *Vernonia* (*Vernonanthura*) *lucida* Less. which also lacks dense pubescence on the underside of the leaves. Instead, the underside of the leaves of *V. cabralensis* have scattered T-shaped hairs. The heads of the new species are also larger than those of *V. lucida* and its closest relatives, with mostly ca. 15 rather than mostly ca. 8-10 florets.

There are very unusual hairs or hair-like structures abaxially on the leaves that have a swollen, capsule-like base with many small cells





**Fig. 6.** Scanning Electron photographs of Vernoniaceae trichomes. A. Detached hairs of *Critoniopsis macrofoliata* showing some branching and basal spurs. B, C, D. *Vernonanthura cabralensis*; B. Abaxial surface showing numerous infected hairs; C, D. Bases of infected hairs showing lateral insertion.

inside and a proliferated tip with small-celled filaments. The latter “hairs” are on the leaves of all four specimens, and they often occur rather regularly dispersed. SEM investigation of the hairs shows that the attachment is L- or T-shaped. In the March 1997 collection (Hatschbach et al. 66230) the hairs are sparse and glandular dots are numerous. In the May 2001 collections (Hatschbach et al. 72044, 72087, 72101) the “hairs” are more common and they seem to replace the glands. Such structures are considered here as real hairs or glands that are infected with some fungus. If true, the fungus is widespread in the species. Such hairs have not been seen on other species, but a complete survey has not been made.

The longitudinal lines or ducts in the corolla lobes are the type seen thus far only in the genera *Trepadonia* (Robinson, 1994), *Vernonanthura*, and *Vernonia*.

### ACKNOWLEDGMENTS

Marjorie Knowles has helped extensively with loans and other specimens, SEM sessions, and proofreading. Scott Whittaker, head of the SEM Laboratory is thanked for operating the Leica stereoscan 440 SEM microscope with a Lanthanum hexaboride (LaB<sub>6</sub>) electron source. The type specimens were scanned by Ingrid Lin.

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**INFRA-SPECIFIC VARIATION IN *JUNIPERUS DEPPEANA*  
AND F. *SPERRYI* IN THE DAVIS MOUNTAINS OF TEXAS:  
VARIATION IN LEAF ESSENTIAL OILS AND RANDOM  
AMPLIFIED POLYMORPHIC DNAs (RAPDs)**

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**ABSTRACT**

A recent report of a possible *Cupressus arizonica* growing in the Davis Mtns., prompted field work to collect samples from the furrowed bark tree (Bridge Spring) and compare these with another tree with furrowed bark (Elbow Canyon) as well as typical *Juniperus deppeana* and *Cupressus arizonica*. During the collections, two trees were found that had only juvenile leaves and very elongated terminal whips, so they were included in the analyses of the leaf essential oils and DNA fingerprinting (RAPDs). The trees with furrowed bark and those with elongated terminal whips all had DNA bandings typical of *J. deppeana* in the area, not like *Cupressus arizonica*. Analyses of the leaf essential oils showed both the furrowed bark and elongated terminal whips trees to have oil that was typical of *J. deppeana* and not like the oil of *C. arizonica*. The *J. deppeana* oils contained 17 terpenoids not found in the oil of *C. arizonica*. The leaf oil of *C. arizonica* contained 29 compounds that were not found in the oils of the *J. deppeana* trees. The Bridge Spring tree that has been previously reported as *Cupressus arizonica*, is identified as *Juniperus deppeana* f. *sperryi* with foliage rather erect than drooping. A second tree of *J. d. f. sperryi* was found in Elbow Canyon. The two trees with almost all juvenile leaves and elongated terminal whips are recognized as a new forma, *Juniperus deppeana* f. *elongata* R. P. Adams.

**KEY WORDS:** *Juniperus deppeana*, *J. d. f. sperryi*, *J. d. f. elongata*, *Cupressus arizonica*, Cupressaceae, terpenes, DNA, RAPDs, systematics, essential oil.

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Recently, there has been some confusion concerning the occurrence of *Cupressus arizonica* in the Davis Mtns. of west Texas. Karges and Zach (2001) reported finding a tree of *Cupressus arizonica* on the Nature Conservancy's Davis Mtns. preserve just below Bridge Spring. The specimen was apparently without female cones, so identification was based on leaf morphology. It is very difficult to separate some *Cupressus* and *Juniperus* species using only leaf data. The Bridge Spring juniper has bark exfoliating in interlaced strips, but with quadrangular bark at the very base of the trunk. Subsequently, cpDNA sequences from this specimen were compared with *C. arizonica*, *J. deppeana* and other *Juniperus*, *Calocedrus*, *Chamaecyparis*, and *Thuja* species (Griffith and Bartel, 2002). The cpDNA data (Griffith and Bartel, 2002) showed the putative *C. arizonica* (Karges and Hedges 2480, Karges s. n.) from Bridge Spring to form a clade with *J. deppeana*. Although that clade was only supported by a 63 bootstrap value, the clade, including the Bridge Spring tree was nested within other *Juniperus* clades. Karges and Zech (2003) questioned some procedures in the Griffith and Bartel (2002) analysis, such as the lack of use of *J. deppeana* samples from the Davis Mtns., and the citation of Karges s. n. specimen with cone scales. Karges and Zech (2003) state that such a specimen did not exist and that only the Karges and Hedges 2408 specimen without cones exists.

The general confusion concerning identifying *J. deppeana* trees with furrowed bark (cf. f. *sperryi*) in the Davis Mtns. led us to re-examine trees reported as f. *sperryi* or allies as well as the Bridge Spring tree. *Juniperus deppeana* f. *sperryi* (Correll) R. P. Adams is documented only by specimens from the type tree on the H. E. Sproul ranch (O. E. Sperry T870, Adams 352) but furrowed bark trees are reported to occur in other areas of the Davis Mtns.

## MATERIALS AND METHODS

Specimens used in this study: *Juniperus deppeana* var. *deppeana*, Adams 10621-10625, Nature Conservancy's Davis Mtns. Preserve, TX, USA; *J. deppeana* f. *sperryi*, Adams 352, Type tree, Sproul Ranch, Adams 10626, Bridge Spring and Adams 10628, Elbow Canyon, Davis



Mtns., TX, USA; *J. deppeana* f. *elongata*, Adams 10627, 10629, Davis Mtns., TX, USA; *Cupressus arizonica*, Adams 6906, 10650, 10651, cultivated, Waco, TX, USA; Adams 9268, 9269, (ex. Stephanie C. Bartel), Boot Canyon, Chisos Mtns., TX, USA. Voucher specimens are deposited at Baylor University (BAYLU).

Fresh leaves (200 g. fresh wt.) were steam distilled for 2 h using a circulatory Clevenger apparatus (Adams, 1991). The oil samples were concentrated (ether trap removed) with nitrogen and the samples stored at -20°C until analyzed. The extracted leaves were oven dried (48h, 100°C) for determination of their oil yields.

The essential oils were analyzed on a HP5971 MSD mass spectrometer, directly coupled to a HP 5890 gas chromatograph, using a J & W DB-5, 0.26 mm x 30 m, 0.25 micron coating thickness, fused silica capillary column (see Adams, 2001 for operating details). Identifications were made by library searches of our volatile oil library (Adams, 2001), using the HP Chemstation library search routines, coupled with retention time data of authentic reference compounds. Quantitation was by TIC.

Sampling for RAPD data -- One gram (fresh weight) of foliage was placed in 20 g of activated silica gel and transported to the lab, thence stored at -20° C until the DNA was extracted. DNA was extracted from juniper leaves by the Qiagen DNeasy mini kit (Qiagen Inc. Valencia CA). The RAPD analyses follow that of Adams and Demeke (1993). Ten-mer primers were purchased from the University of British Colombia (5'-3'): 134, AAC ACA CGA G; 153, GAG TCA CGA G; 184, CAA ACG GCA C; 212, GCT GCG TGA C; 218, CTC AGC CCA G; 239, CTG AAG CGG A; 249, GCA TCT ACC G; 250, CGA CAG TCC C; 268, AGG CCG CTT A; 327, ATA CGG CGT C; 338 CTC TGG CGG T; 346, TAG GCG AAC G; 347, TTG CTT GGC G; 413, GAG GCG GCG A; 478, CGA GCT GGT C.

PCR was performed in a volume of 15 µl containing 50 mM KCl, 10 mM Tris-HCl (pH 9), 2.0 mM MgCl<sub>2</sub>, 0.01% gelatin and 0.1%

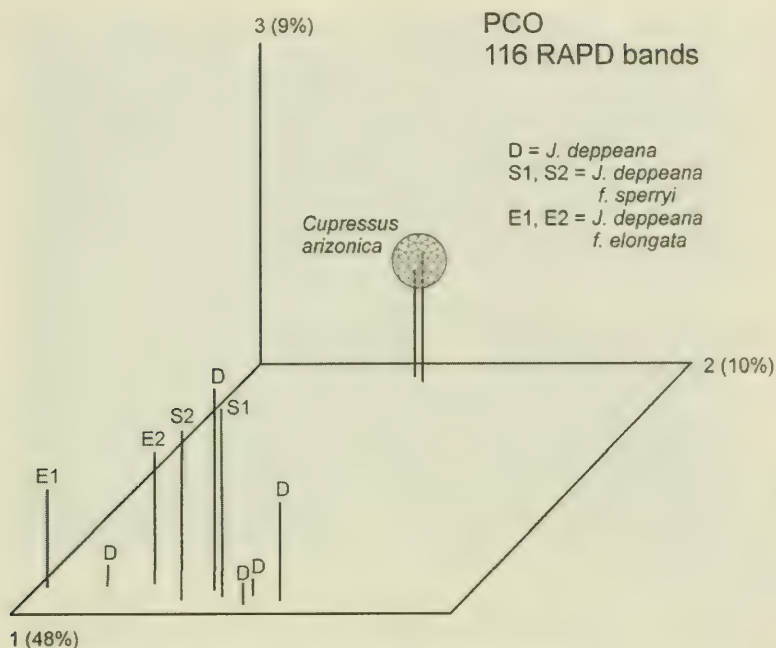
Triton X-100, 0.2 mM of each dNTPs, 0.36  $\mu$ M primers, 0.3 ng genomic DNA, 15 ng BSA and 0.6 unit of Taq DNA polymerase (Promega). A control PCR tube containing all components, but no genomic DNA, was run with each primer to check for contamination. DNA amplification was performed in an MJ Programmable Thermal Cycler (MJ Research, Inc.). The thermal cycle was: 94°C (1.5 min) for initial strand separation, then 40 cycles of 40°C (2 min), 72°C (2 min), 91°C (1 min). Two additional steps were used: 40°C (2 min) and 72°C (5 min) for final extension.

DNA bands that occurred once were not scored. It should be noted that these bands contain very useful information for the study of genetic variance and individual variation, but are merely "noise" in the present taxonomic study. Bands were scored in 4 classes: very bright (=6); medium bright (=5), faint (=4) and absent (=0). See Adams and Demeke (1993) for details on electrophoresis and RAPD band scoring.

Similarity measures were computed using absolute character state differences (Manhattan metric), divided by the maximum observed value for that character over all taxa (= Gower metric, Gower, 1971; Adams, 1975).

## RESULTS AND DISCUSSION

Two trees were discovered that had elongated terminal whips and mostly juvenile leaves (decurrent) on otherwise mature trees. The long terminal whips (15- 30 cm) give the trees a weeping appearance. One of these trees (Adams, 10627, in grassland, 1845 m, on the n. side of Tex. 118, 2.6 mi. west of the w. entrance to Lawrence E. Wood Madera Ck. roadside park) has been reported to RPA by Tom Van Devender (pers. comm.) as a possible *J. d. f. sperryi* tree. The second tree with weeping foliage, elongated whips, and only juvenile leaves at the summit of Brown Mtn., 2190 m, (Adams 10629), Davis Mtns., was shown to RPA by John Karges. These trees were found to have oil and DNA fingerprints like typical *J. deppeana* from the Davis Mtns. Thus, it appears that they differ in only a few genes that are expressed occasionally among otherwise typical *J. deppeana* plants. This elongated whip form is confused with *J. d. f. sperryi* by field workers.

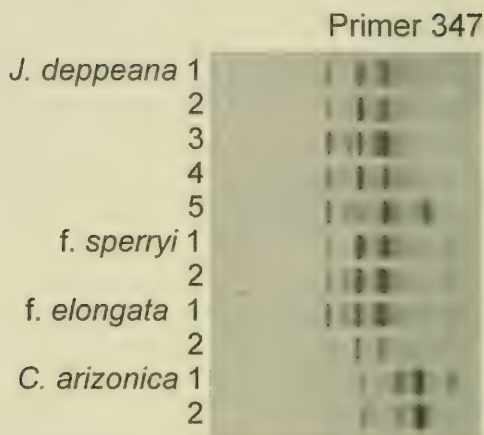


**Figure 1.** Principal Coordinates Ordination (PCO) based on 116 RAPD bands. The Bridge Spring tree (S1) and the other interlaced bark tree from Elbow Canyon (S2) are interspersed with typical *J. deppeana* along with the two trees of *J. d. f. elongata*.

To recognize this variation and prevent future confusion, a new forma of *J. deppeana* is proposed:

*Juniperus deppeana* Steud. f. *elongata* R. Adams, *forma nov.* TYPE: Texas, USA, on Tex. 118, 4.2 km west of w. entrance to Lawrence E. Wood Madera Ck. park, 1845 m, Lat. 30 43.437' N; Long. 104 08.255' W, 11 March 2005, R. P. Adams 10627 (HOLOTYPE: BAYLU, ISOTYPE: SRSC)

*J. deppeanae typicae similis sed differt foliis ramulorum elongatorum plerumque decurrentibus juvenalibus; ramuli demissi.*



**Figure 2.** Agarose gel showing the banding using primer 347 for *Juniperus deppeana* and *Cupressus arizonica*. The *f. sperryi* 1 sample is the tree from Bridge Spring and *f. sperryi* 2 is the tree from Elbow Canyon. Both are clearly a part of typical *J. deppeana* (1-5 above).

Similar to typical *J. deppeana* but different in the leaves of the elongated branchlets mostly decurrent and juvenile; branchlets drooping.

**Other specimen examined:** U.S.A.: Texas, Davis Mtns., Brown Mtn. 2190 m (summit), *R. P. Adams* 10629 (BAYLU, SRSC).

Analysis of the leaf essential oils of the plants in this study is presented in table 1. Notice the Bridge Spring tree (S2) and the Elbow Canyon tree (S3) have oils that are like *J. deppeana* from the Davis Mtns. and *J. deppeana f. elongata* (E1, E2), but quite different from *Cupressus arizonica* oil. Seventeen compounds were found in the *J. deppeana* plants (including *f. sperryi* and *f. elongata*) that were not found in *C. arizonica* (table 1). Conversely, 29 compounds were found only in *C. arizonica*. Umbellulone was 11.2% in *C. arizonica*, but absent in all the *J. deppeana* samples. The diterpenes were noticeably different in *C. arizonica*: cis-14-nor-muulol-5-en-4-one,

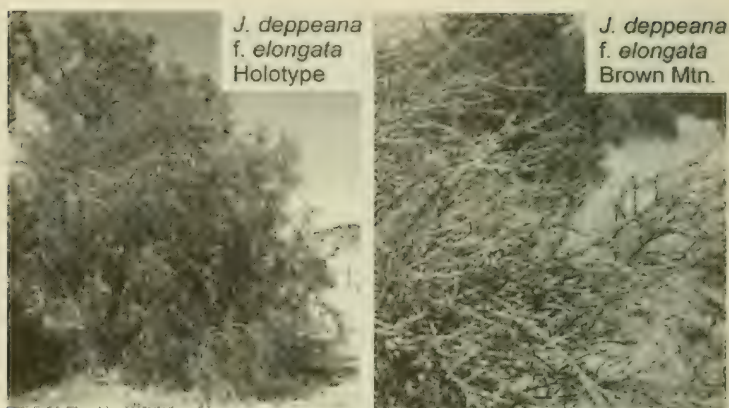




**Figure 3.** Bark of *J. deppeana*, *J. deppeana* f. *elongata*, *J. deppeana* f. *sperryi* (Bridge Spring tree) and *Cupressus arizonica*. Note the quadrangular bark at the base of the Bridge Spring tree.

isopimara-9(11),15-diene, isohibaene, sandaracopimara-8(14),15-diene, isophyllocladene, phyllocladene, abieta-8,12-diene, nezukol, phyllocladanol, semperviol and trans-totarol. Of the 132 compounds quantitated within *J. deppeana* - *C. arizonica* (table 1), 46 were found only in *Juniperus* (17) or in *Cupressus* (29). It is clear that the leaf oils of *J. d. f. sperryi* and f. *elongata* are quite similar to the oil of *J. deppeana* from the same area.

Principal coordinate analysis (PCO) of 116 RAPD bands extracted eigenroots accounting for 48.3, 9.5, 8.7, 7.7, 5.8% of the variance among the samples. These eigenroots appear to asymptote after the second or third root, implying lack of significance for subsequent eigenroots. PCO of the first three axis reveals that the first eigenroot (48%) separates *C. arizonica* from *Juniperus* samples (Fig. 1). The individuals of *J. deppeana*, *J. d. f. sperryi* (S1 is the Bridge Spring individual), and *J. d. f. elongata* are all interspersed (Fig. 1).



**Figure 4.** Habit and foliage of *J. deppeana* f. *elongata*, Holotype (left) and Brown Mtn. (right) trees.

Figure 2 shows a gel photo for primer 347. The major bands present in *Juniperus* samples are absent in *Cupressus* samples and the major bands in *Cupressus* are absent in *Juniperus*. Although there are some polymorphisms in the *J. deppeana* samples, they are clearly part of a defined group (as seen in the 116 RAPD based PCO, Fig. 1).

The bark of *J. deppeana* varies (Adams, 2004) from quadrangular (in var. *deppeana* and var. *robusta*) to exfoliating in narrow, often interlaced strips (in var. *patoniana* and f. *sperryi*). A comparison of bark variation in the Davis Mtns. is shown in figure 3 along with bark from *C. arizonica*. The bark of the *J. d.* f. *sperryi*, Bridge Spring tree exfoliates in interlaced strips on the upper trunk, but in quadrangular plates at the base of the trunk (Fig. 3). Notice (Fig. 3) that the bark of the type tree of *J. d.* f. *elongata* has an unusual, thin quadrangular scaly bark. This might be the result of the tree being genetically fixed in the juvenile leaf form. The presence of only juvenile leaves on adult juniper trees is rare, but has been reported (Adams, 2004) in many *Juniperus* species. However, some juniper species are characterized by having only or mostly juvenile leaves (*J. chinensis*) on adult trees.

The general habit of the type tree of *J. deppeana* f. *elongata* (Adams 10627) and a close up of the elongated terminal whips on another tree of *J. d.* f. *elongata*, at the summit of Brown Mtn., are shown in figure 4. At present, these are the only two known trees of the new forma, but it is likely that additional trees will be discovered.

We now know of three trees of *J. d.* var. *sperryi* in the Davis Mtns., but again, additional trees will likely be discovered.

### ACKNOWLEDGEMENTS

Thanks to Guy Nesom for providing the Latin description. Thanks to John Karges for providing field assistance and to Stephanie Bartel for providing specimens of *C. arizonica* from the Chisos Mtns. This research was supported in part with funds from NSF grant DEB-316686 (A. Schwarzbach and R. P. Adams) and funds from Baylor University.

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**Table 1.** Comparisons of the per cent total oil for leaf essential oils for *J. deppeana* (DP), *J. deppeana* f. *sperryi* (S1, *Adams 352*, Sproul Ranch; S2, *Adams 10626*, Bridge Spring; S3, *Adams 10628*, Elbow Canyon), *J. deppeana* f. *elongata*, (E1, *Adams 10627*; E2, *Adams 10628*) and *Cupressus arizonica* (CAz, average of three tree oils, *Adams 6906*, *10650*, *10651*). Compounds are in boldface that separate the taxa.

KI	Compound	DP	S1	S2	S3	E1	E2	CAz
926	tricyclene	0.4	0.1	t	0.9	0.1	t	t
931	$\alpha$ -thujene	0.3	0.3	t	0.6	0.2	0.3	0.5
939	$\alpha$ -pinene	8.2	12.7	3.8	3.8	5.1	9.2	7.2
953	$\alpha$ -fenchene	t	-	-	-	-	-	t
953	camphene	0.7	0.3	0.2	1.1	0.3	0.7	0.2
957	thuja-2,4(10)-diene	0.1	-	-	t	0.3	-	-
967	verbenene	0.1	1.0	0.2	0.1	t	-	-
976	sabinene	5.2	5.2	2.4	8.0	5.2	3.2	2.6
980	$\beta$ -pinene	0.7	2.0	0.3	0.7	0.5	0.3	0.3
991	myrcene	2.3	2.9	2.1	3.7	2.6	1.6	2.0
<b>1001</b>	<b><math>\delta</math>-2-carene</b>	<b>0.1</b>	<b>t</b>	<b>t</b>	<b>0.2</b>	<b>0.2</b>	<b>3.4</b>	-
1005	$\alpha$ -phellandrene	1.0	0.7	1.2	2.1	2.0	0.8	t
1011	$\delta$ -3-carene	4.9	t	0.3	2.4	-	4.0	0.3
1018	$\alpha$ -terpinene	0.7	1.2	0.7	1.2	1.0	0.5	0.8
1026	p-cymene	1.4	3.8	0.9	2.1	1.3	1.8	0.7
1031	limonene	1.0	t	1.0	t	0.1	2.9	3.0
1031	$\beta$ -phellandrene	8.0	7.0	9.5	13.7	10.9	5.7	3.2
1050	(E)- $\beta$ -ocimene	0.2	0.2	0.2	0.2	0.2	0.1	-
1062	$\gamma$ -terpinene	1.2	2.8	2.1	2.2	1.6	0.8	1.2
1068	cis-sabinene hydrate	0.7	3.4	2.1	1.5	0.5	0.1	0.5
1074	trans-linalool oxide	0.1	-	-	-	-	0.3	-
1082	m-cymenene	0.1	-	-	-	-	0.4	-
1088	terpinolene	1.7	1.1	1.6	1.7	1.5	1.6	1.1
1091	6,7-epoxymyrcene	0.1	-	-	-	-	-	-
1096	96, 109, 152, terpene alcohol	-	1.1	-	-	-	-	-
<b>1097</b>	<b>trans-sabinene hydrate</b>	-	-	-	-	-	-	<b>0.3</b>
1098	linalool	4.1	2.9	5.5	1.7	5.7	2.8	0.4
1121	cis-p-menth-2-en-1-ol	1.3	1.7	1.6	1.2	1.7	1.4	0.3
1125	$\alpha$ -campholenal	0.5	0.2	0.3	t	0.3	1.3	t
1134	cis-limonene oxide	0.2	-	-	-	-	0.8	-
1140	trans-p-menth-2-en-1-ol	1.1	1.3	0.8	-	t	1.9	0.4
1143	camphor	14.1	7.6	26.5	19.9	18.7	3.1	1.2
1148	camphene hydrate	0.9	0.6	1.3	0.9	0.9	0.4	t
1156	sabina ketone	0.4	0.3	-	-	0.4	0.6	-
1161	59, 79, 94, 152, terpene alcohol	-	-	-	-	-	1.1	-
1165	borneol	-	0.3	-	-	-	-	-
<b>1168</b>	<b>umbellulone(=3-thujen-2-one)</b>	-	-	-	-	-	-	<b>11.2</b>
<b>1170</b>	<b>p-mentha-1,5-dien-8-ol</b>	<b>0.9</b>	<b>0.2</b>	<b>0.5</b>	<b>0.7</b>	<b>0.8</b>	<b>2.2</b>	-
1173	cis-pinocampnone	0.2	0.6	-	-	-	0.1	-

1177	terpinen-4-ol	3.3	10.1	5.8	4.5	4.7	2.8	3.2
1180	m-cymen-8-ol	0.5	-	-	-	-	1.4	-
1183	p-cymen-8-ol	0.5	0.2	-	0.3	0.4	0.9	0.7
<b>1183</b>	<b>cryptone</b>	<b>0.4</b>	<b>0.3</b>	<b>0.5</b>	<b>0.4</b>	<b>0.5</b>	<b>0.9</b>	-
1189	$\alpha$ -terpineol	2.0	1.0	1.6	2.3	4.0	2.8	1.1
1191	myrtenol	-	0.3	0.1	-	-	-	-
1193	cis-piperitol	0.6	0.3	0.2	0.4	0.6	1.1	t
1195	methyl chavicol	-	-	0.7	-	-	-	-
1202	83, 95, 109, 152, terpene alcohol t	0.5	-	-	-	-	-	-
1204	verbenone	0.4	-	0.3	0.2	0.3	1.0	0.1
1205	trans-piperitol	0.5	1.0	0.4	0.3	0.4	1.0	0.1
1217	trans-carveol	0.1	-	-	-	0.2	0.9	t
<b>1219</b>	<b>cis-sabinene hydrate acetate</b>	-	-	-	-	-	-	<b>0.2</b>
1228	citronellol	-	0.6	-	-	-	-	0.2
1235	trans-chrysanthenyl acetate	0.2	-	0.7	0.2	0.2	-	-
<b>1235</b>	<b>thymol, methyl ether</b>	-	-	-	-	-	-	<b>0.2</b>
1239	cumin aldehyde	0.1	-	t	0.1	0.2	0.3	-
<b>1242</b>	<b>carvone</b>	<b>0.2</b>	<b>0.2</b>	<b>t</b>	<b>t</b>	<b>0.1</b>	<b>0.7</b>	-
<b>1252</b>	<b>piperitone</b>	<b>0.7</b>	<b>2.0</b>	<b>1.5</b>	<b>1.0</b>	<b>1.3</b>	<b>8.6</b>	<b>t</b>
<b>1257</b>	<b>linalyl acetate</b>	<b>1.2</b>	<b>0.2</b>	<b>1.2</b>	<b>0.4</b>	<b>0.6</b>	<b>t</b>	-
1264	alcohol, FW 152, 123, 91, 77	0.2	-	0.5	0.2	0.4	1.5	-
<b>1285</b>	<b>bornyl acetate</b>	<b>3.1</b>	<b>1.7</b>	<b>1.0</b>	<b>1.7</b>	<b>2.3</b>	<b>0.2</b>	-
1290	thymol	0.3	0.3	t	0.1	t	0.2	t
<b>1294</b>	<b>2-ethyl isomenthone</b>	-	-	-	-	-	-	<b>0.1</b>
<b>1293</b>	<b>2E, 4Z-decadialenal</b>	<b>0.2</b>	<b>0.3</b>	<b>t</b>	<b>0.2</b>	<b>t</b>	<b>0.2</b>	-
1298	carvacrol	0.2	-	-	t	0.1	-	-
<b>1300</b>	<b>terpinen-4-ol, acetate</b>	-	-	-	-	-	-	<b>0.5</b>
<b>1314</b>	<b>2E, 4E-decadialenal</b>	<b>0.4</b>	<b>0.3</b>	<b>t</b>	<b>0.5</b>	<b>t</b>	<b>0.2</b>	-
1346	trans-piperitol acetate	-	-	-	-	-	0.3	-
1350	$\alpha$ -terpinyl acetate	5.8	0.5	4.4	4.5	2.9	6.3	0.7
<b>1376</b>	<b><math>\alpha</math>-copaene</b>	<b>0.3</b>	<b>0.3</b>	<b>t</b>	<b>t</b>	<b>0.3</b>	<b>0.1</b>	-
<b>1384</b>	<b><math>\beta</math>-bourbonene</b>	-	-	-	-	-	-	<b>0.2</b>
<b>1390</b>	<b><math>\beta</math>-cubebene</b>	<b>0.2</b>	<b>t</b>	<b>t</b>	<b>0.1</b>	<b>0.2</b>	<b>0.1</b>	-
1402	longifolene	0.6	-	-	0.2	0.2	0.3	-
1418	(E)-caryophyllene	t	0.3	-	t	t	-	0.2
<b>1419</b>	<b><math>\beta</math>-cedrene</b>	-	-	-	-	-	-	<b>0.1</b>
1429	cis-thujopsene	-	-	-	-	-	0.3	-
1444	cis-murrola-3,5-diene	0.5	0.3	0.5	0.4	0.7	0.3	3.6
1454	$\alpha$ -humulene	0.1	0.2	t	t	t	t	0.2
<b>1461</b>	<b>cis-murola-4(14),5-diene</b>	-	-	-	-	-	-	<b>9.2</b>
<b>1473</b>	<b>trans-cadina-1(6),4-diene</b>	<b>0.5</b>	<b>0.2</b>	<b>0.5</b>	<b>0.4</b>	<b>0.6</b>	<b>0.3</b>	-
<b>1480</b>	<b>germacrene D</b>	-	-	-	-	-	-	<b>0.3</b>
1491	trans-murola-4(14),5-diene	1.2	-	1.2	1.0	1.5	0.6	-
<b>1493</b>	<b>epi-cubebol</b>	<b>0.9</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.7</b>	<b>0.6</b>	-
<b>1499</b>	<b><math>\alpha</math>-muurolene</b>	<b>0.2</b>	<b>0.2</b>	<b>0.1</b>	<b>0.2</b>	<b>0.3</b>	<b>0.1</b>	-
<b>1501</b>	<b>epizonarene</b>	-	-	-	-	-	-	<b>2.2</b>
1513	$\gamma$ -cadinene	-	-	-	0.9	-	-	-
<b>1513</b>	<b>cubebol</b>	<b>2.1</b>	<b>1.8</b>	<b>1.7</b>	<b>0.9</b>	<b>2.3</b>	<b>1.6</b>	-
<b>1521</b>	<b>trans-calamenene</b>	-	-	-	-	-	-	<b>1.3</b>
1524	$\delta$ -cadinene	1.8	0.9	1.1	1.1	1.6	1.4	0.4
<b>1526</b>	<b>zonarene</b>	<b>0.3</b>	<b>0.2</b>	<b>0.4</b>	<b>0.2</b>	<b>0.4</b>	<b>0.1</b>	-
1532	trans-cadina-1(2),4-diene	0.2	-	t	0.1	0.2	0.1	-
<b>1534</b>	<b>10-epi-cubebol</b>	-	-	-	-	-	-	<b>0.9</b>

<b>1536 italicene ether</b>	-	-	-	-	-	-	<b>1.1</b>
1540 $\alpha$ -copaen-11-ol	-	-	-	-	-	0.8	-
1542 $\alpha$ -calacorene	-	0.1	-	-	-	t	-
<b>1550 cis-muurolo-5-en-4-<math>\beta</math>-ol</b>	-	-	-	-	-	-	<b>2.6</b>
<b>1549 elemol</b>	<b>0.5</b>	<b>2.7</b>	<b>0.4</b>	<b>0.3</b>	<b>0.7</b>	<b>t</b>	-
<b>1559 cis-muurolo-5-en-4-<math>\alpha</math>-ol</b>	-	-	-	-	-	-	<b>3.0</b>
1574 germacrene D-4-ol	-	-	-	0.2	-	-	-
1581 caryophyllene oxide	0.5	0.4	0.1	0.3	0.3	0.3	0.2
1596 cedrol	0.3	t	t	-	0.3	0.7	1.2
1606 humulene epoxide II	0.4	0.2	0.7	0.3	0.4	0.2	0.3
<b>1618 1,10-di-epi-cubenol</b>	-	-	-	-	-	-	<b>0.3</b>
<b>1627 1-epi-cubenol</b>	<b>1.7</b>	<b>0.9</b>	<b>1.5</b>	<b>1.2</b>	<b>1.6</b>	<b>1.1</b>	-
<b>1630 <math>\alpha</math>-acorenenol</b>	-	-	-	-	-	-	<b>3.4</b>
<b>1637 <math>\beta</math>-acorenenol</b>	-	-	-	-	-	-	<b>0.6</b>
1640 epi- $\alpha$ -cadinol	0.2	0.1	0.4	0.4	0.2	0.1	0.3
1640 epi- $\alpha$ -muurolol	0.3	0.2	0.4	0.4	0.3	0.1	-
1645 $\alpha$ -muurolol (=torreyol)	0.2	t	0.1	t	t	t	-
1649 $\beta$ -eudesmol	0.2	0.4	t	t	0.2	t	-
1652 $\alpha$ -eudesmol	0.1	-	-	-	0.1	-	-
1653 $\alpha$ -cadinol	0.2	0.3	0.7	0.4	0.1	t	1.1
1674 cadalene	0.1	-	-	-	-	t	0.3
<b>1689 cis-14-nor-muulol-5-en-4-one</b>	-	-	-	-	-	-	<b>2.6</b>
<b>1789 8-<math>\alpha</math>-acetoxylemol</b>	<b>0.1</b>	<b>t</b>	<b>1.5</b>	<b>0.3</b>	<b>0.3</b>	<b>t</b>	-
<b>1906 isopimara-9(11),15-diene</b>	-	-	-	-	-	-	<b>0.1</b>
<b>1933 isohibaene</b>	-	-	-	-	-	-	<b>0.2</b>
<b>1960 sandaracopimara-8(14),15-diene</b>	-	-	-	-	-	-	<b>0.2</b>
1998 epi-13-manoyl oxide	1.2	0.7	2.3	t	1.5	2.5	-
<b>1966 isophyllocladene(=kaur-15-ene)</b>	-	-	-	-	-	-	<b>0.1</b>
<b>2017 phyllocladene</b>	-	-	-	-	-	-	<b>0.1</b>
2017 manoyl oxide	t	t	t	-	t	t	-
<b>2022 abieta-8,12-diene</b>	-	-	-	-	-	-	<b>0.1</b>
2054 abietatriene	0.1	0.2	t	-	t	t	0.2
2080 abietadiene	0.2	0.1	0.1	0.1	0.4	0.2	1.9
<b>2133 nezukol</b>	-	-	-	-	-	-	<b>3.7</b>
<b>2210 phyllocladanol</b>	-	-	-	-	-	-	<b>3.9</b>
<b>2283 semperviol</b>	-	-	-	-	-	-	<b>0.3</b>
2288 4-epi-abietal	t	t	-	-	-	-	-
<b>2314 trans-totarol</b>	-	-	-	-	-	-	<b>0.3</b>
<b>2302 abieta-7,13-dien-3-one</b>	<b>0.6</b>	<b>0.1</b>	<b>0.4</b>	<b>0.5</b>	<b>0.7</b>	<b>0.7</b>	-
2325 trans-ferruginol	t	t	t	-	t	-	t

KI = Kovat's Index on DB-5(= SE54) column. \*Tentatively identified.

Compositional values less than 0.1% are denoted as traces (t).

Unidentified components less than 0.5% are not reported.

**A NEW SPECIES OF *SYNCRETOCARPUS* (ASTERACEAE:  
HELIANTHEAE: HELIANTHINAE) FROM CENTRAL PERU**

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**ABSTRACT**

*Syncretocarpus ancashino* is described and illustrated and its salient features compared to the other two species of the genus.

**KEY WORDS:** Asteraceae-Heliantheae-Helianthinae-Syncretocarpus

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Among the sunflowers collected in a recent field trip to Peru we have identified a new species of *Syncretocarpus* S. F. Blake that we describe below. *Syncretocarpus* is endemic to Peru and a member of the mostly Mexican subtribe Helianthinae characterized by its sterile ray flowers, compressed cypselae with a pappus of mostly two awns and several squamellae in between. With the description of this novelty the genus now contains three species, all from dry rocky canyons flanking rivers flowing to the Pacific coast of Peru.

**MATERIALS AND METHODS**

Measurements reported in the description were obtained from the type collection. The description was enhanced by observations made of live plants growing in the type locality.

**DESCRIPTION**

*Syncretocarpus ancashino* Panero & A. Granda P. **sp. nov.** (Fig. 1)

Type. PERU. Ancash: Cañón del Pato, carretera Caráz-Huallanca, 12 May 2000, J. L. Panero, B. S. Crozier, and M. Arakaki 7575 (Holotype USM; Isotypes: CTES, HAO, MOL, TEX, TENN).



*A. S. sericeus inflorescentiis majoribus, corollis tenue flavis, capitulis campanulatis, foliis linearis vel lanceolatis, et eleosoma nullo differt.*

Small shrubs or perennial herbs 1.0-2.0 m tall, older stems light brown, distal branches densely puberulent, whitish brown. Leaves alternate, blades linear to narrowly lanceolate, 1.0-6.0 cm long, 2.0-5.0 mm wide, petioles 2.0-5.0 mm long. Capitulescences solitary or very open paniculate cymes of 2-9 heads. Heads radiate, turbinate to campanulate, 1.6-1.8 cm high, 8.0-9.0 mm wide. Phyllaries 16-24 in 2-3 graduated series, puberulent with resin dots, pubescence denser on distal half; phyllaries of first series ovate, 3.5-4 mm long, 1.3-1.7 mm wide, phyllaries of second series ovate to oblong 6.0-8.5 mm long, 3.0-4.5 mm wide, phyllaries of third series oblong, 9.0-10 mm long, 1.5-3.0 mm wide. Pales oblong to ovate in outline with two folds that produce three segments, the central segment is as wide as the cypselae and the side segments are equivalent and overlap each other enclosing and wrapping the basal half of the cypselae tightly, 1.1-1.2 cm long, ca. 4.0 mm wide, puberulent, pubescence denser on distal half. Ray flowers 8-11, sterile, limb oblong, light yellow, 1.1-1.4 cm long, 3.5-4.5 mm wide, apex bifid, densely puberulent along veins on abaxial surface with a few resin dots scattered in between the veins; tube puberulent, 2.5 mm long; ovary 4.4-4.7 mm long, densely puberulent. Disc flowers 24-30, perfect, light yellow turning deep orange to red with age, tubular, throat ca. 6 mm long, sparsely puberulent, tube 1.5-1.7 mm long, 0.9-1.0 mm wide, moderately puberulent, lobes broadly triangular, ca. 1.0 mm long, ca. 1.5 mm wide; stamens 5, anther thecae yellow-orange, ca. 3.5 mm long, anther appendage ca. 0.8 mm long; style deep yellow, ca. 7.0 mm long, style branches ca. 1.5 mm long, tips triangular with no tapering appendage. Disc cypselae obovate to obtriangular, silvery sericeous, trichomes 3.7-4.2 mm long, basalmost area glabrous, black, 6.0-7.0 mm long, ca. 2.0 mm wide, elaiosome lacking, pappus of 2 awns and 4 squamellae, stramineous, awns oblanceolate, tapered, 5.7-7.0 mm long, squamellae oblong, 2.5-2.8 mm long, 0.7-0.9 mm wide. (Fig. 1).



**Figure. 1.** *Syncretocarpus ancashino* **sp. nov.** (A) Flowering branch. (B) Cypsela. (C) Habit and view of type locality. Drawn from *Panero, Crozier & Arakaki 7575*.

## DISCUSSION

*Syncretocarpus ancashino* is a ruderal species from the sandy cliffs of the Huallanca region of the Santa River canyon of northern Ancash department in central Peru. The species grows with other ruderal composites including *Acmella* Rich., *Heterosperma* Cav., and *Porophyllum* Adans.. *Syncretocarpus ancashino* replaces *Syncretocarpus sericeus* S. F. Blake in the drier areas of the canyon. The new species occupies disturbed habitats along the road in the narrow Huallanca canyon before the road takes an abrupt descent to the arid coast of northern Peru where hardly any sunflower is present except for weedy species exploiting the humidity at the edge of rice and sugarcane fields maintained by irrigation.

*Syncretocarpus ancashino* can be easily separated from the abundant *S. sericeus* by the color of its corollas (light yellow vs. golden yellow), narrower leaves (lanceolate vs. ovate), the shape of its heads (campanulate vs. hemispherical), and cypselae that lack elaiosomes (very conspicuous in *S. sericeus*). The third species of *Syncretocarpus*, *S. similis* S. F. Blake is only known from the type specimen collected in central Ica Department in south-central Peru. *Syncretocarpus similis* is scarcely different from *S. sericeus* and might prove to be conspecific. Given that the new species is endemic to Ancash, we found appropriate to honor this Peruvian department by adopting for the name of the species the common name Peruvians give to those that live or were borne in Ancash department.

## ACKNOWLEDGEMENTS

We thank Asunción Cano and the staff of USM for logistical support in Peru. We thank Bonnie Crozier and Monica Arakaki for assistance in the field. Herbarium specimens were collected under authorization and stipulations of the Instituto Nacional de Recursos Naturales of Peru (INRENA) collecting permit 2000-0001 issued to JLP.

**PHYMATOCEROS STOTLER, W. T. DOYLE & CRAND.-  
STOTL., GEN. NOV. (ANTHOCEROTOPHYTA)**

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**ABSTRACT**

*Phymatoceros* Stotler, W. T. Doyle & Crand.-Stotl., **gen. nov.**, is described subsequent to study of the type specimen of *Anthoceros bulbiculosus* Brot. from Portugal and living material from both Portugal and California, U.S.A. This new genus is a segregate from *Phaeoceros* Prosk. but differs in several critical features, among them plastid structure, spore color, and the production of a single antheridium per antheridial chamber.

**KEY WORDS:** Anthocerotophyta, California, Hornworts, Mediterranean, *Phaeoceros*, *Phymatoceros*

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During our study of the hornworts of California, a genus similar to, but distinct from, *Phaeoceros* Prosk. has been identified; the following Latin diagnosis is given here to make that name immediately available for use.

*Phymatoceros* Stotler, W. T. Doyle & Crand.-Stotl., **gen. nov.**

*Phymatoceros* differt a *Phaeoceros* chloroplastis sine pyrenoidibus, thallis fugacibus, ferentibus tubera plurima, locellis antheridiorum continentibus unum tantum antheridium, et sporis fusi ubi maturis.



Type Species: *Phymatoceros bulbiculosus* (Brot.) Stotler, W. T. Doyle & Crand.-Stotl., **comb. nov.**; Basionym: *Anthoceros bulbiculosus* Brot., Flora Lusitanica 2: 430. 1804[1805]. Neotypus: legit *Fernandes, Neves & Santos s.n.*, Coimbra, Portugal, 23.iv.1954, UC ! (acc. no. 985943).

The genus name is derived from the Greek *phyma*, -tos, n. tumor, growth and *keras*, -atos, n; *keros*, m [*ceros*- ] horn; in reference to the prolific tuber production of the thallus in this hornwort.

In contradistinction to all other hornworts, this monotypic genus possesses a suite of morphological traits that distinguish it from all other genera, but especially from *Phaeoceros* where the type species had previously been placed. As in most hornwort genera, it is characterized by the production of a single chloroplast per vegetative cell, but there are no pyrenoids in the plastids. Plants are dioicous rather than monoicous and are dimorphic. They are ephemeral, occurring in open, exposed sites during the rainy season with prolific tuber production. The gametophytes are narrow and do not form rosettes but rather grow as linear to lingulate thalli. Only a single antheridium develops in each antheridial chamber rather than 2 to 4 per chamber as in *Phaeoceros*. The spores are yellow as in *Phaeoceros*, only near the capsule base, above the intercalary meristem region where they are immature. In mature, field-dried capsules they become a fuscous brownish-black to black at the split capsule tips. The capsules split mostly on one side only rather than on two sides. Characteristics of secondary importance include the lack of schizogenous cavities in the thalli, smooth rhizoids, untiered antheridial jacket cells, sporophytes with an intercalary meristem, stomates, a columella, and thin-walled, multicellular pseudoelaters that lack spiral thickenings. We place *Phymatoceros* into Notothyladaceae (Milde) Müll. Frib. ex Prosk. subfamily Phaeocerotoidae Hässel.

Proskauer (1957), in his detailed treatment of *Phaeoceros bulbiculosus* (Brot.) Prosk. ( $\equiv$  *Phymatoceros bulbiculosus*) reported this taxon as widespread in the Mediterranean region of Europe and Africa, and in North and South America. Although he referred to a

subspecies in California, he did not formally name one nor do we formally recognize the California populations as distinct (Stotler & Crandall-Stotler 2005).

### SELECTED SPECIMENS EXAMINED

PORTUGAL. Cabris. Coimbra, nos taludes de uma vala, *Fernandes, Neves, & Santos s.n.* (UC, neotype of *Anthoceros bulbiculosus*); Baixo Alentejo, Parque Natural do Guadiana, Ribeira de Limas, 11.02.2004, *Sérgio s.n.* (LISU); Estremadura: Serra da Arrábida, Vila Nogueira de Azeitão, Casais de Porela, Piedade, Sito, 140m, 22.01.2005, *Sérgio s.n.* (ABSH, LISU). U.S.A. CALIFORNIA. Marin County, Mill Valley, Feb. 22, 1896, *Howe s.n.* (NY, holotype of *Anthoceros phymatodes*); Mill Valley, Mar. 19, 1892, *Howe s.n.* (NY (2), UC, paratypes of *Anthoceros phymatodes*); Santa Cruz County, Fuel Break Road nr. Junction with Red Hill Road, U. C. Santa Cruz, 6 May, 1996, *Doyle s.n.* (ABSH); San Luis Obispo County, El Chorro Regional Park, 550 ft., 26 April, 1998, *Doyle 9471* (ABSH); Mendocino County, North Coast Ranges, Little Lake Road, on soil in open areas, 540 ft., 14 May, 2003, *Doyle 10,421* (ABSH).

### ACKNOWLEDGEMENTS

Special thanks are extended to Celia Sérgio and Manuela Sim-Sim (LISU) for sending us living material from Portugal. We also thank William Buck (NY) and Brent Mishler (UC) for the loan of herbarium specimens. This work was supported by NSF—PEET Grant DEB 9977961, to RES and BJC-S, which is gratefully acknowledged.

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THE STATUS OF *BLEPHILIA* (LAMIACEAE) IN TEXAS

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## ABSTRACT

*Blephilia hirsuta* and *B. ciliata* have been mentioned as occurring in Texas by several authors, but, until now, no voucher specimens have been located. *Blephilia hirsuta* is documented as occurring in Texas for the first time, while reports of *B. ciliata* in Texas seem to be based on a mis-determination of a specimen of *Monarda clinopodioides*.

**KEY WORDS:** Lamiaceae, *Blephilia*, Texas.

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*Blephilia* Rafinesque (Lamiaceae) is a genus of perennial erect or ascending herbs that are closely allied to *Monarda*. The major difference between the two genera that supports generic separation is the two-lipped (bilabiate) calyx, whereas *Monarda* has a calyx with five somewhat equal teeth. *Blephilia* is currently recognized to consist of three rather variable species of eastern North America (Simmers and Kral 1992). One species, *B. subnuda* Simmers & Kral, is endemic to the Cumberland Plateau province of northern Alabama. The other two, *B. ciliata* (L.) Benth. and *B. hirsuta* (Pursh.) Benth., have large, essentially sympatric distributions encompassing most of eastern North



America (USDA, NRCS 2005). Both have had a rather contradictory history in Texas. Small (1933), Fernald (1950), Correll & Johnston (1970), and Hatch et al. (1990) have attributed both to the state. As is normal for floras, neither Small nor Fernald document the presence by citation of a specimen. Correll and Johnston (1970) added this disclaimer to their treatment, "No Texas material has been seen. They are included here based on Fernald's [1950] report of their occurrence in the state." The distribution for both species was given as "possibly in n.e. Texas." Hatch et al. (1990), in their checklist of the vascular flora of the state, noted the following: "Expected to be in Area 1 by C. & J." Area 1 is the Pineywoods of east Texas, while C. & J. is a reference to Correll and Johnston (1970). The statement is best interpreted to mean that neither of the species has been documented as occurring in Texas. Others, such as Robinson (1896) and Small (1913), have cited *B. hirsuta* in Texas while Johnston (1990), in a list updating the *Manual of the Vascular Plants of Texas*, retained *B. ciliata* as part of the flora, but excluded *B. hirsuta* with the statement "We still have no evidence that this species occurs in Texas." This seems to imply that there is reason for retaining *B. ciliata* as part of the state's flora. However, in personal communication with the senior author on file at BAYLU, Johnston remarked that there is no justifiable reason for its inclusion in the state. The checklists of Gould (1962) and Jones et al. (1997), as well as the *Atlas of the Vascular Plants of Texas* (Turner et al., 2003), the latest work to enumerate the flora of the state, did not include *Blephilia* as part of the state's flora. Finally, the genus is not cited as occurring in Texas by USDA, NRCS (2005). It is evident from the literature review that neither species of *Blephilia* has ever been documented in the state by citation of a voucher specimen and that exclusion from last three references cited effectively removes *Blephilia* as a known part of the flora of the state. Our research into the occurrence of *Blephilia* in Texas has yielded the following.

***Blephilia ciliata*.** As best can be determined, *B. ciliata* was first mentioned as occurring in Texas by Small (1933) where he gave the distribution as "Fla. to Tex." Fernald (1950) stated the distribution as "Ga., Miss., Mo. and e. Tex." To Texas botanists, both of these distributions imply that the species occurs in that part of the state

known as the Pineywoods, which is the western part of the vast southeastern pine-oak-hickory forest. Correll and Johnston (1970) stated that *B. ciliata* was "possibly in n.e. Texas" which was interpreted by Hatch et al. (1990) as the Pineywoods, but, in the broad sense, could also refer to the Post Oak Savannahs that lie to the west of the Pineywoods. It appears likely that this distribution is based upon the proximity of northeast Texas to the more northern occurrences of the species in Arkansas and Oklahoma. Our search efforts resulted in locating the following specimen, which seems to be the basis for reporting *B. ciliata* in the state. The specimen was originally in the personal herbarium of Thomas C. Porter that was later acquired by the Academy of Natural Sciences of Philadelphia (at which time the original label, which is in an envelope, was copied and attached to the sheet). We are citing the original label. The only other item of interest is the annotation as *Blephilia ciliata* (L.) Benth. by Sharon S. & Arthur O. Tucker in 1994.

*Blephilia ciliata*, Raf. Ft. Belknap—Texas. 1855. leg. Dr. Vollum [s.n.].

Fort Belknap is in Young County, about 3 miles south of Newcastle on Texas Hwy 251. The fort was founded in 1851, originally on the Red Fork of the Brazos River, but was moved later that year to its present location. The area is now a park and museum. Young County is located in the western edge of the Cross Timbers and Prairies (Gould 1962, Correll and Johnston 1970, Hatch et al. 1990). Fort Belknap is approximately 400 km west southwest of the nearest known occurrence of *B. ciliata* in McCurtain and LeFlore counties in Oklahoma. From a phytogeographic point of view, this appears to be an improbable location for this species. Examination of the specimen showed it to have tubular calyx consisting of five equal calyx teeth and not a bilabiate calyx typical of *Blephilia*. The specimen is referable to *Monarda clinopodioides* A. Gray, a species found throughout the eastern half of Texas (Turner et al. 2003, Diggs et al. 1999). All indications are that *Vollum s.n.* was used as the basis for citing *B. ciliata*, hence it follows that the species should not be considered as part of the Texas flora.

***Blephilia hirsuta*.** An inquiry to GH resulted in the discovery and loan of a specimen of *B. hirsuta* from Texas. The "label" data, written directly on the herbarium sheet, had the following information: "Texas. Wright." The "label" and specimen are attached to the left side of the sheet and, as is typical with Wright specimens from east Texas, is unnumbered. As was common practice in the Gray Herbarium at that time (pers. comm. with David E. Boufford (GH) quoted in Singhurst et al. 2000), another specimen was placed on the right side of the sheet. This is a specimen of *B. hirsuta* from Missouri collected by Fritchey in 1857, which has no role in this matter. Surprisingly, the Texas specimen was annotated by Donovan Correll in 1968 as *B. hirsuta*. Apparently through some oversight, the information about the specimen was not included in Correll and Johnston (1970) as was done with other once collected species such as *Isopyrum biternatum* (Raf.) Torr. & A. Gray (Ranunculaceae), *Habenaria (Platanthera) integra* (Nutt.) Spreng. (Orchidaceae), and *Smilax herbacea* L. (Smilacaceae). While the Wright specimen does document the occurrence of *B. hirsuta* in the state, it does not provide precise information about when and where it was collected. Correll and Johnston (1970) mention the occurrence as "possibly in n.e. Tex." which appears based upon the proximity of northeast Texas to the occurrences of the species in Oklahoma and Arkansas. While that appears a likely site for rediscovery of *B. hirsuta*, it is doubtful that the Wright specimen is from there. Wright worked as a surveyor in east Texas from 1837-45, after which he left to take a position at Rutgersville College in Lagrange, Fayette County. According to Geiser (1948), which is summarized in Singhurst et al (2000), Wright's activities were mostly confined to Angelina, Jasper, Newton, and Tyler counties. Except for the northern portion of Angelina County, these counties are mostly contained in the longleaf pine region, which is an unlikely location for *Blephilia*. No mention is made of Wright traveling to northeast Texas. It is probable that the specimen is from a non-longleaf pine area of one of the four east Texas counties cited above that was collected during Wright's tenure there (1837-45).

### ACKNOWLEDGMENTS

We thank GH for the loan of the Wright specimen of *Blephilia hirsuta* and PH for loan of the Vollum specimen from Ft. Belknap, both making this study possible. Margie Knowles assisted by searching for specimens of *Blephilia* at US while Tom Zanoni did the same at NY. We are also grateful to Marshall Johnston for his comments on the occurrence of *Blephilia* in the state. Finally, Eric Keith and Laura Sanchez reviewed the manuscript and made suggestions for improvement.

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**THREE SPECIES OF VASCULAR PLANTS NEW TO TEXAS****Jason R. Singhurst**

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**ABSTRACT**

*Alstroemeria pulchella* (Liliaceae), *Ctenium aromaticum* (Poaceae), and *Decumaria barbara* (Saxifragaceae) are reported as new to Texas.

**KEY WORDS:** *Alstroemeria*, *Ctenium*, *Decumaria*, Liliaceae, Poaceae, Saxifragaceae, Texas.

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Continued field study on the flora of Texas has resulted in discovery of the following species that are considered as new to the state.

*Alstroemeria pulchella* L. f. (Liliaceae), lily-of-the Incas, Peruvian lily, or parrot lily, a native of Brazil, is an outdoor ornamental that has become naturalized (*sensu* Pyšek et al. 2004) in Florida, Alabama,

Mississippi, and Louisiana (Holmes 2002). The species is cited in Texas by Jones et al. (1997) as “[cultivated],” which basically refers to plants that do not escape. This slender and weak stemmed herb has dilated petioles that are twisted so as to invert the leaf.

About 100 plants in bloom were established in front of an abandoned house, which indicates their origin as ornamentals, and onto the roadside. They had spread along the edge of the nearby woods and to the roadside for a distance of about 50 meters from the house. All were growing in very shady areas mostly under large oak (*Quercus* spp.) trees.

There is some uncertainty as to the correct name of this species. Bailey (1949) used the name *A. psittacina* Lehmann for this species, as did Thomas and Allen (1993). We are, however, following the Flora of North America usage.

Voucher specimen: Texas. **Newton Co.**: Roadside of FM 1414, ¼ mi E of int. w/ Hwy 87, 9 Jun 2004, *Keith 717* (BAYLU).

*Decumaria barbara* L. (Saxifragaceae), wood-vamp, a native of southeastern United States, was located in a seepage slope (poor fen) at the base of Farkleberry Sandhill (a sandhill dominated by *Quercus incana*, *Q. margaretta*, and *Q. hemisphaerica*). The seep contact is below and approximately parallel with the edge of the sandhill and is only about 30 m wide. At the lower end it merges into a wet baygall containing *Cyrilla racemiflora*, *Viburnum nudum*, *V. nitidum*, *Itea virginica*, *Lyonia ligustrina*, *Rhododendron oblongifolium*, *Osmunda cinnamomea*, *O. regalis*, *Woodwardia areolata*, *Bartonia texana*, *Plantanthera clavellata*, *Sphagnum* sp., *Apteris aphylla*, *Acer rubrum*, *Carex glaucescens*, *Myrica heterophylla*, *Doellingeria sericocarpoides*, *Magnolia virginiana*, and *Nyssa sylvatica*.

About 130 plants, ranging in size from 30–40 cm to about 1 meter, were documented in three separate population clusters. None of the plants has flowered since their discovery in 2002. The species has the same growth characteristics in west-central Louisiana (pers. comm. with Charles Allen). Our determination was confirmed by Edwin

Bridges, who, with the senior author, visited the site in September 2004. *Decumaria* is occasionally placed in the segregate family Hydrangeaceae.

The species was included in Correll and Johnston (1970) on the distinct possibility that it occurs in the state, but with the remark that no specimen was seen. Hatch et al. (1990) listed the species in their checklist of the vascular flora of the state, but with the annotation "Expected in Area 1." (i.e., the pineywoods of east Texas). However, Johnston (1990), in a checklist updating the Manual of the Vascular Plants of Texas deleted the species as part of the flora of the state. He mentioned "I have found no evidence that this species occurs in Texas." The following specimen documents the occurrence of the species in the state.

Voucher specimen: Texas. **Newton Co.:** Temple Inland proposed Sand Hill Cemetery Distinctive Site, jct. of St. Rt. 363 and Big Cow Creek, E 0.4 mi, then N ca. 2.7 mi, 7 Mar 2002, *Singhurst 11,223* (BAYLU).

*Ctenium aromaticum* (Walter) Alph. Wood (Poaceae), toothache grass, is widely distributed along the lower and mid-Gulf and Atlantic coastal plains from Virginia to western Louisiana (Barkworth 2003). The species is highly fire-adapted and occurs in savannahs, pine flatwoods, and pitcher plant bogs. The species occurred in two small areas (patches); both covering no more than 1000 sq. meters each, in a wetland pine savanna that merges with a low hillside seepage swale. Associated flora included *Sphagnum* spp., *Xyris iridifolia*, *Xyris ambigua*, *Xyris platylepis*, *Rhynchospora gracilentia*, *R. glomerata*, *R. oligantha*, *R. pusilla*, *R. plumosa*, *Andropogon virginicus* var. *glaucus*, *Eriocaulon compressum*, *E. decangulare*, *Toe fieldia racemosa*, *Physostegia longisepala*, *Aletris aurea*, and *Lycopodiella alopecuroides*.

The location is essentially continuous with the known Louisiana distribution, where it is reported from similar sites in Allen,

Beauregard, and Vernon parishes (Thomas and Allen, 1993), and indicates that the species should be considered native. The low population and restricted known distribution of the species in Texas make it a candidate for conservation concern.

Voucher specimen: Texas. **Newton Co.**: E side of U.S. Hwy 87, 12 mi. N of jct. of Hwy 87 and I-10 in Orange, 12 May 2003, *Singhurst 13,340* (BAYLU).

### ACKNOWLEDGEMENTS

We are grateful to Charles Allen and Edwin Bridges for their assistance and to Dana Price and Chris Wells for review of the manuscript.

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**AGRIMONIA GRYPOSEPALA (ROSACEAE) DELETED FROM  
THE LOUISIANA FLORA**

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MacRoberts (1984, 1989), Thomas and Allen (1998), Kartesz and Meacham (1999), NatureServe (2004), U.S.D.A. (2004), and LSU (2004) include *Agrimonia gryposepala* Wallr. in the Louisiana flora. This inclusion is based on a specimen citation in a paper by Correll and Correll (1941). The specimen (*Correll and Correll 10137* DUKE) was collected in Caddo Parish, Louisiana, on 8 August 1938. Caddo Parish is in the northwest corner of Louisiana. *Agrimonia gryposepala* is not reported from surrounding states (MacRoberts 1984, 1989, Taylor and Taylor 1989, Hatch et al. 1990, Smith 1994, Jones et al. 1997, Thomas and Allen 1998, Turner et al. 2003, Oklahoma Vascular Plant Database 2004, NatureServe 2004, U.S.D.A. 2004).

We examined *Correll and Correll 10137* and found it to be *Agrimonia rostellata* Wallr. It had been annotated to *A. rostellata* by Mac H. Alford in 1999.

**ACKNOWLEDGMENTS**

Thanks to Sherri Herndon, Duke University Herbarium, for providing the specimen. Chris Reid, Louisiana Natural Heritage Program, and Larry Brown, Spring Branch Science Center Herbarium, reviewed the paper.

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**FROM ESPINOSA'S STRAWBERRY VINES TO  
LINDHEIMER'S FAN-SHAPED AGAVES WITH FORTY-FOOT  
STEMS: THE PITFALLS OF TAKING TRANSLATIONS OF  
EARLY DESCRIPTIONS AT FACE VALUE**

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Spanish explorers seem to have covered about every inch of what is now Texas, and wherever they went they wrote descriptions of the landscape, flora and fauna. In the 1930s the Texas Catholic Historical Society translated into English these handwritten journals, now in the archives in Mexico City. But when we consider that the priests translating these journals did not necessarily have any special interest in botany or zoology, we should realize that at times it may be necessary to look behind the translations to see what the Spanish explorers really wrote.

In 1716 Fray Isidro Felix de Espinosa, a Mexican priest accompanying a Spanish expedition, wrote in his diary a description of the flora he saw at San Antonio Springs, now Brackenridge Park, in San Antonio. Any naturalist familiar with Brackenridge Park who reads the commonly used translation of this passage will be startled to learn that Espinosa purportedly saw "very tall cactus," and "strawberry vines." These references caused one botanist friend of mine to throw away the baby with the bath water, maintaining that Espinosa was seeing things and his description was therefore of no value. But inspection of the handwritten diary in Spanish, on microfilm at the Latin American Collection of the University of Texas Library, Austin, reveals that Espinosa recorded no such botanical wonders. He wrote of seeing *nogales altisimos* (very tall pecan trees), not *nopales altisimos* (very tall cactus). Tall pecan trees are an expected part of the San Antonio Springs flora, and can be seen there today. Very tall cactus, of course, is not. Evidently the translator had read the "g" of *nogales* as a



"p," thus converting the pecan trees into cactus. This was a careless mistake. The handwriting is clear; one can easily distinguish the writer's "g"s and "p"s by comparing them to the "g"s and "p"s of other words in the manuscript. The "g" of *nogales* is clearly identical with the "g" of *agua*, and plainly differs from the "p" of *capaz*.

As for the strawberry vines, a glance at the diary entry reveals that the word Espinosa actually wrote was *madroños*, or what we call madrones, trees that were possibly growing there in 1716. So how did the translator come up with "strawberry vines?" Consulting my Velázquez Spanish/English dictionary, I see that *madroño* is translated as "madrone," or as "strawberry tree," an expression used by the English to refer to a species of madrone that occurs in Spain. For whatever reason the translator, who likely knew nothing of madrones, chose "strawberry tree" instead of "madrone" to translate *madroños*, then, for whatever reason, converted "trees" to "vines."

In this same passage, the journal entry describing San Antonio Springs, Espinosa writes of seeing *palmitos legítimos*, which was translated as "genuine fan palms." Since I study native Texas palms and their distribution, and the translation is vague, I had to determine exactly what Espinosa meant by *palmitos legítimos*. Many would assume that *palmitos* obviously meant (dwarf) "palmettoes" (*Sabal minor*), a common enough plant in Texas, and would have let it go at that. But an examination of the wild plants in Brackenridge Park, which still retains some bottomland forest, reveals no dwarf palmetto, nor have I ever seen any in all San Antonio (although they do occur in the Hill Country north of San Antonio). You do see many young palms escaping cultivation in San Antonio, but the ones I've seen have all been *Sabal mexicana*, not *Sabal minor*. And why would Espinosa consider the humble *Sabal minor* palms to be the ones that had the distinction of being *legítimos*?

The explanation goes back to Spain, where there is a species of dwarf fan palm called *palmito* (*Chamaerops humilis*), and this palm has an edible heart, also called *palmito*. When the Spanish explorers came to the New World they continued to call heart-of-palm *palmito*,

and also called any kind of palm, tall or dwarf, they encountered that had an edible heart *palmito*. And the usage continues. According to Mexican botanist Ignacio Piña Lujan, in an article titled "*El Palmito*" (in *Cactaceas y Suculentas Mexicanas* 17: 84-92), *palmito* is the common name for *Sabal mexicana* (which has an edible heart) in the Huasteca region of northeastern Mexico. While Espinosa was not from the Huasteca region, he was from what is now the Mexican state of Querétaro, which apparently has no *S. mexicana*, but borders on the Huasteca region. With that background, his travels northward, and his evident interest in plants, he was probably familiar with *palmitos*, and recognized them when he saw them at San Antonio Springs. Why *legítimos*? Words such as *palma* and *palmito* are used loosely in Spanish to mean yuccas as well as palms. I suspect Espinosa wanted his readers to know that he was seeing not yuccas but the real thing, a palm he already knew well. And if you go to San Antonio Springs (Brackenridge Park) today you will see no dwarf palmetto, but you will see *Sabal mexicana*, both planted along roads, and coming up wild in the woods, where the young palms are easily mistaken for dwarf palmetto. Today in Olmos Park, just upstream from Brackenridge Park, there is a small grove of *S. mexicana* hidden in the woods.

*S. mexicana* is Texas' only other native palm species (besides *S. minor*), and only tree-size native palm species. For decades botanists believed *S. mexicana* was native no farther north than the Lower Rio Grande Valley, until a remnant natural population was discovered near Victoria in 1989. Carefully interpreted, the Espinosa diary constitutes evidence as to how far inland the range of this palm extended--until the north-of-the-LRGV population was almost totally removed, for use of the trunks as pilings for wharves, and for landscaping.

While Ferdinand Lindheimer was botanizing in Texas in the 1840s he corresponded with George Engelmann, at the Missouri Botanical Garden. These letters were handwritten in German, in an archaic script. Nevertheless the late Minetta Goyne undertook to translate these letters, now in the possession of the Missouri Botanical Garden. In 1991 she published her translation in a book titled *A Life among the Texas Flora: Ferdinand Lindheimer's letters to George*

*Engelmann*. As Goyne explains, deciphering Lindheimer's handwriting was the most difficult part of the task.

According to Goyne's translation, in a letter dated 22 Jan. 1845, from "Camp on the Agua Dulce," which Lindheimer located as "7 miles from Port Lavaca on the West Matagorda Bay," Lindheimer wrote:

I collected seeds of the fanshaped agave ["*Facherpulke*"] with stem that is often 20' to 40' high.

Coming upon this sentence in Goyne's book, while reading it cover to cover looking for references to palm trees, I immediately sensed that the reference was to palms, not to a kind of agave one can scarcely imagine. Also I was helped by the fact that a wild population of *Sabal mexicana* had been discovered on Garcitas Creek, 15 miles north of Port Lavaca, and that one of these *S. mexicana*, that had fallen, had a trunk that measured 37 feet.

But how did Goyne get "fanshaped agave?" When Lindheimer scrawled the German word *palme* he left a gap at the top of the "a," making it look like a "u," and made the first loop of the "m" much higher than the second loop, so that Goyne interpreted the "m" as a "k." This produced the word *pulke*, which she interpreted as a German spelling of the Spanish word *pulque*, meaning a Mexican alcoholic beverage made from the juice of agaves. From this she reasoned that Lindheimer, who had lived in Mexico and was presumably familiar with *pulque*, and who, she knew from his writings, liked to play with words, had used the word *pulke* to mean agave.

But when I called Goyne, telling her about the Garcitas Creek palms, and asking her to take another look at the sentence, she explained that she had had no idea that palm trees had ever occurred in that area, and quickly agreed that the correct interpretation of the word in question was *Facherpalme* ("fan palm") rather than the very far fetched *Facherpulke*, translated as "fanshaped agave."

Because of his misreading of *nogales* "pecan trees" as *nopales* "cactus," the translator of Espinosa's diary was careless. But I make no such accusation of Goyne, who was doing the best she could with an extremely difficult manuscript, and with no reason to suspect that wild palm trees, with trunks up to 40 feet, had ever occurred near Port Lavaca. I only hope that no botanist, reading of the "fanshaped agave," has rejected her book as unworthy of attention.

# INDEX TO NEW NAMES AND COMBINATIONS IN PHYTOLOGIA 87(2)

<i>Asterodae</i> H. Rob. <b>supertribus nov.</b>	73
<i>Chresta hatschbachii</i> H. Rob., <b>sp. nov.</b>	83
<i>Critoniopsis diazii</i> H. Rob., <b>sp. nov.</b>	84
<i>Critoniopsis macrofoliata</i> H. Rob., <b>sp. nov.</b>	88
<i>Gemmabryum</i> J.R. Spence & H.P. Ramsay <b>gen. nov.</b>	63
<i>G. acuminatum</i> (Harv. ex Hook.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	65
<i>G. apiculatum</i> (Schwaegr.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	65
<i>G. australe</i> (Hampe) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	65
<i>G. austrosabulosum</i> J.R. Spence & H.P. Ramsay <b>nom. nov.</b>	65
<i>G. cheelii</i> (Broth.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	65
<i>G. chrysoneuron</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. clavatum</i> (Schimp.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. coarctatum</i> (Bosch & Sande Lac.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. coronatum</i> (Schwaegr.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. crassum</i> (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. dichotomum</i> (Hedw.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. eremaeum</i> (Catcheside) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	66
<i>G. exile</i> (Dozy & Molk.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. inaequale</i> (Tayl.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. indicum</i> (Dozy & Molk.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. klinggraeffii</i> (Schimp.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. laevigatum</i> (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. pachythemum</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	64
<i>G. preissianum</i> (Hampe) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	67
<i>G. radiculosum</i> (Brid.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>G. rubens</i> (Mitt.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>G. sauteri</i> (B.S.G.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>G. subapiculatum</i> (Hampe) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>G. sullivani</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>G. tenuisetum</i> (Limpr.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	68
<i>Gymnanthemum triflorum</i> (Bremek.) H. Rob., <b>comb. nov.</b>	80
<i>Hilliardiella sutherlandii</i> (Harv.) H. Rob., <b>comb. nov.</b>	82
<i>Juniperus deppeana</i> Steud. f. <i>elongata</i> R. Adams, <b>forma nov.</b>	101
<i>Leiboldia guerreroana</i> (S.B. Jones) H. Rob., <b>comb. nov.</b>	82
<i>Lepidaploa irwinii</i> H. Rob., <b>sp. nov.</b>	89
<i>Leptostomopsis</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay <b>gen. et stat. nov.</b>	70
<i>L. systylium</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay, <b>comb. nov.</b>	70



<i>Linzia accommodata</i> (Wild) H. Rob., <b>comb. nov.</b>	82
<i>Ochiobryum</i> J.R. Spence & H.P. Ramsay <b>gen. nov.</b>	69
<i>O. blandum</i> (Hook. f. & Wils.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	69
<i>O. handelii</i> (Broth.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	70
<i>Parapolydora</i> H. Rob., <b>gen. nov.</b>	78
<i>Parapolydora fastigiata</i> (Oliver & Hiern) H. Rob., <b>comb. nov.</b> ,	79
<i>Phymatoceros</i> Stotler, W. T. Doyle & Crand.-Stotl., <b>gen. nov.</b>	114
<i>P. bulbiculosus</i> (Brot.) Stotler, W. T. Doyle & Crand.-Stotl., <b>comb. nov.</b>	115
<i>Ptychostomum</i>	
<i>P. altisetum</i> (Müll. Hal.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	63
<i>P. cylindrothecium</i> (R.Br.ter.) J.R. Spence & H.P. Ramsay <b>comb. nov.</b>	63
<i>Syncretocarpus ancashino</i> Panero & A. Granda P. <b>sp. nov.</b>	110
<i>Vernonanthura cabralensis</i> H. Rob., <b>sp. nov.</b>	92







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## SUBSCRIPTION INFORMATION

*PHYTOLOGIA* is published three times a year, P.O. Box 2012, Sam Houston State University, Huntsville, TX 77341-2012. Annual domestic individual subscription (3 issues): \$30.00. Annual domestic institutional subscription (3 issues): \$90.00. Foreign and/or airmail postage extra.

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